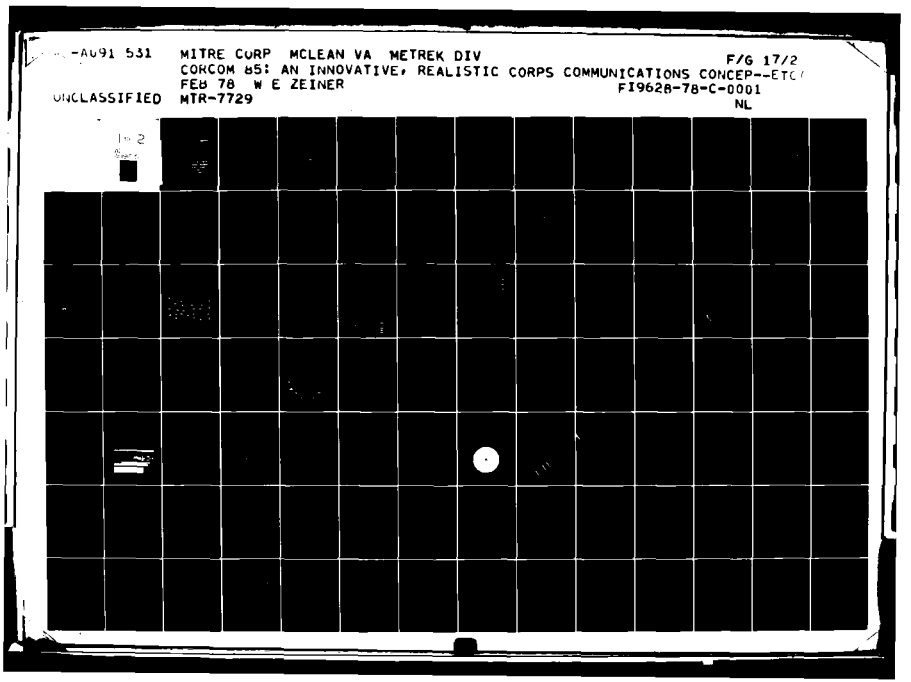
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CORCOM 85: An Innovative, Realistic Corps Communications Concept for the 1985 Army

William E. Zeiner

METREK Division of The MITRE Corporation, MTR-7729

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MITRE Technical Report

MTR-7729

CORCOM 85: An Innovative, Realistic Corps Communications Concept for the 1985 Army

William E. Zeiner

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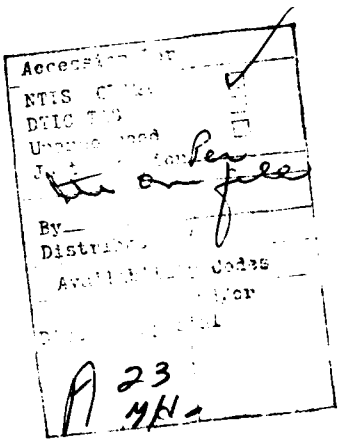
ABSTRACT

A triad of tactical communications systems (conventional terrestrial communications, communications using satellite relays, and a tactical information distribution system (TIDS*)) should be the main elements of the future Army tactical communications capability. This is an alternative to the current trend in Army communications development.

TIDS offers several new communications capabilities, and its employment could revolutionize battlefield communications. The use of TIDS by a division is outlined. Key issues relating to TIDS are identified and one, network connectivity, is discussed in detail. Finally, several actions needed to implement the triad concept are identified.



*TIDS is also referred to currently as the Army Data Distribution System (ADDS).

ACKNOWLEDGEMENT

The author wishes to acknowledge the contributions of MITRE staff members John Bell, Emanuel Maimone and Seymour Roth to the work described herein, particularly with regard to characterizing the single channel communications nets in a typical division and performing the tedious analysis of network connectivity for representative TIDS configurations. Acknowledgement is also due the Electromagnetic Compatibility Analysis Center (ECAC) which provided the source data for the network connectivity analysis.

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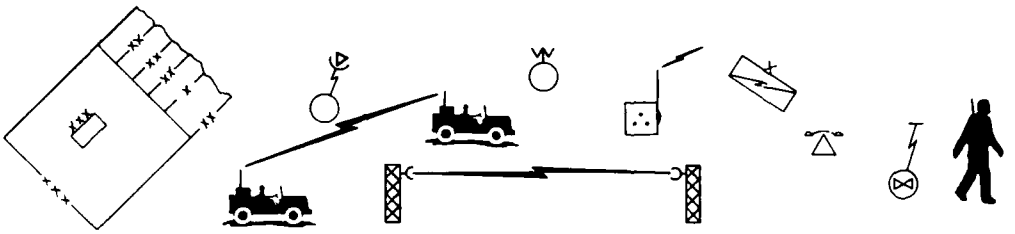
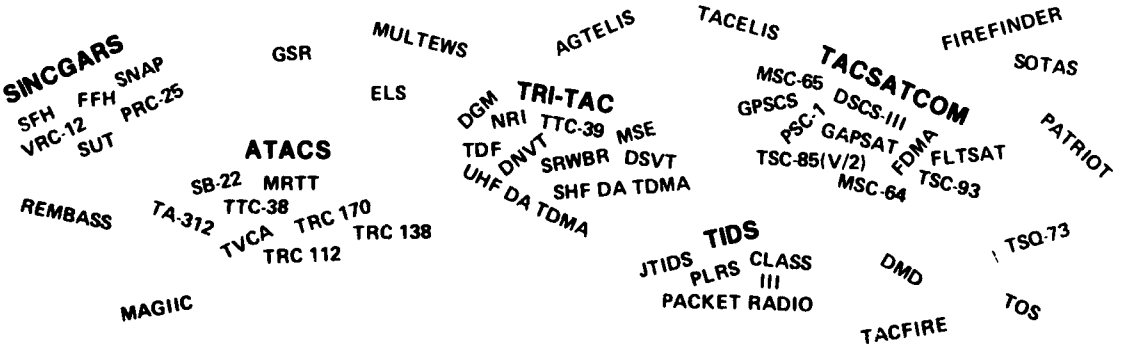


CORCOM 85

An Innovative, Realistic Corps Communications Concept for the 1985 Army



1.0 INTRODUCTION

This report describes a new concept for tactical communications for the 1985 Army. It documents a briefing delivered to MG Hunt, Director for Battlefield Systems Integration (DBSI), U.S. Army Development and Readiness Command (DARCOM) on 29 November 1977. This work is part of MITRE's ongoing support to DBSI in the area of tactical communications.

A typical corps was chosen for the analysis because it reflects the full range of diverse communication requirements likely to be needed by the Army.

There is a need to update the Army's tactical communications planning and development programs to keep in step with changing doctrine, new requirements and current or emerging technology. The results of the 1972-1975 Integrated Tactical Communications System (INTACS) Study established the foundation for further evolution of the Army's tactical communications, and served as a starting point for this effort.

As indicated to the left, a bewildering array of communications equipment is currently under development. How this equipment fits together to satisfy future requirements is unclear. New sensor and weapon systems will require new approaches to information distribution and command and control. New technology, as embodied in a tactical information distribution system (TIDS), offers innovative opportunities for future tactical communications. Yet current Army tactical communications must evolve realistically, using existing inventory equipment, where practicable, and new equipment where desirable. This report describes a concept for future communications that is both innovative and realistic.

CORCOM 85

SCOPE

- Background
- The problem
- Current army communications
- The trend
- CORCOM 85 (An alternative)
- The CORCOM 85-TRIAD
- TIDS "Overlay"
  - — Need
  - — Architecture
  - — Impact
  - — Description
  - — Issues
  - — Connectivity
- Required action

2.0 SCOPE

The following pages will cover the subjects listed on the chart. A brief description of current multichannel and single channel communications and their inadequacies will set the stage for a postulation of future tactical communications capabilities that will result if current trends continue.

An alternative approach to tactical communications - dubbed CORCOM 85 - will be described. This alternative is based on a triad comprised of conventional communications, communications using satellite relay, and a tactical information distribution system. The Tactical Information Distribution System is referred to as the (TIDS)* "Overlay." The word "overlay" is intended to indicate that a generic TIDS could be added to the Army's current and programmed communications with minimal near term disruption to current planning while significantly enhancing long term communications capability.

TIDS use by various groups within a typical corps will be sketched. Potential TIDS characteristics will be described and issues associated with TIDS will be identified. The most fundamental of these - connectivity - will be dealt with in greater detail.

Finally, Army action required to implement the CORCOM 85 concept will be outlined.

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* TIDS has been redesignated recently by the Army. The new acronym is ADDS for Army Data Distribution System. To preserve continuity and to avoid many time consuming changes to the briefing charts, the former designation used in the original briefing - TIDS - will be used throughout this report.

CORCOM 85

BACKGROUND

- Current tactical communications are inadequate
- Failure to capitalize on new and emerging technologies
- "Force multiplier" effect of timely battlefield information exchange

3.0 BACKGROUND

In recent years there has been growing concern over the inadequacy of current tactical communications.

- The terrestrial multichannel communications system is not suited to the mobility requirements of forward maneuver elements.
- Equipment, procedures, and doctrine are aging or outmoded. This obsolescence is exemplified by the VRC-12 VHF/FM net radio series, electromechanical teletypewriters, and the continued administrative separation of the message center from the remainder of the communications system.
- Most equipment is susceptible to overt enemy electronic warfare or targeting action and much of the equipment cannot be helped by modification.
- Numerous training and maintenance problems have surfaced during field training exercises and in recent REFORGER exercises.
- Little progress has been made toward the standardization and interoperability with NATO communications required by Public Law 94-361 (14 July 1976) and reaffirmed by the President and Secretary of Defense early this year.

Over the years Army tactical communications have not used new technologies such as high capacity, multi-beam, spread spectrum, satellite communications; packet switching; mobile subscriber communications; "smart" micro-processor-based teletype and facsimile terminals. Current plans do not include use of emerging technologies such as those employed by the several digital data distribution schemes now being investigated.

This last point is particularly unfortunate because timely battlefield information exchange, of the type offered by application of these technologies, could be a true "force multiplier." It could redress force imbalances by assuring that critical combat and sensor reports are disseminated quickly and accurately. It could also help other closed loop battlefield systems or automated administration and logistics systems operate more efficiently.

CORCOM 85

PROBLEM STATEMENT

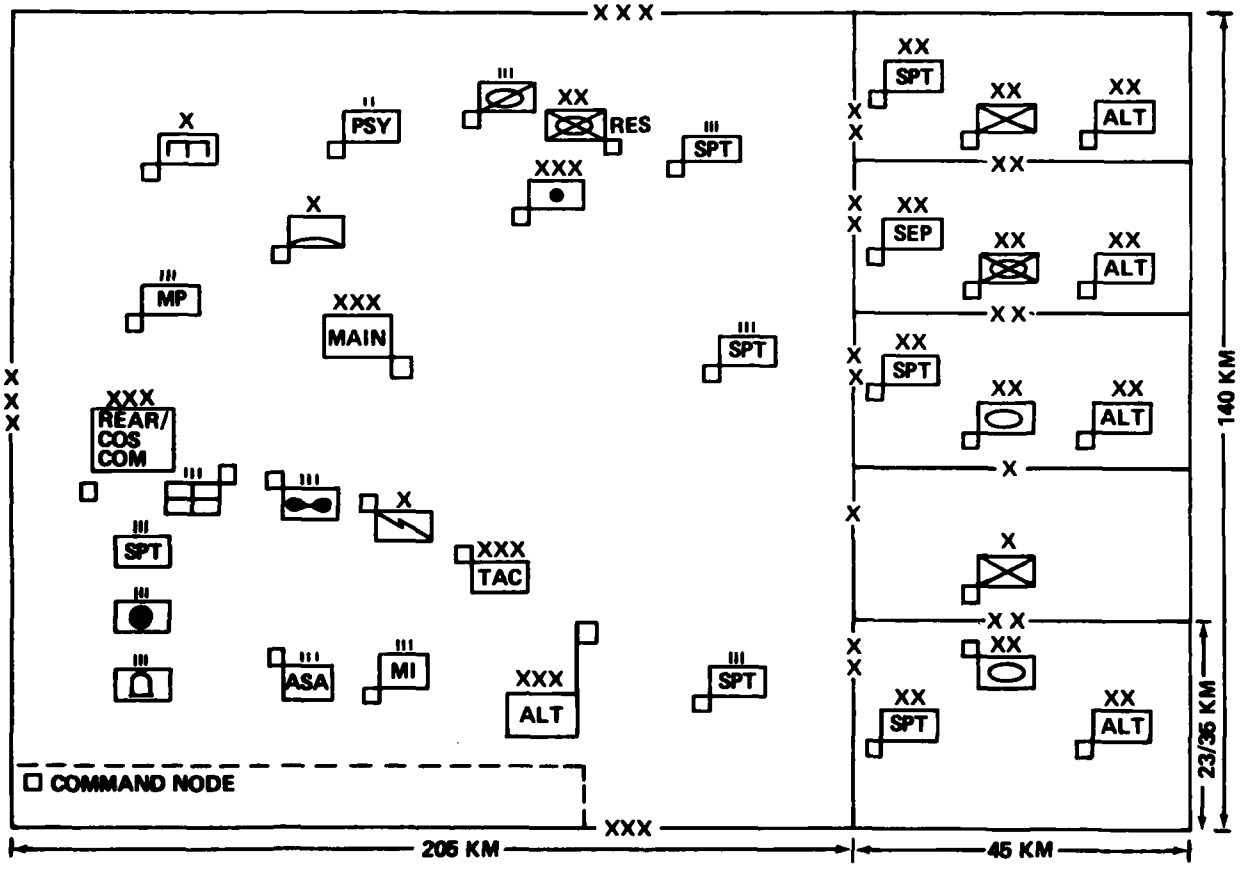
In the absence of strong action now, the 1985 army will have to rely on a piece part, patchwork communications capability insufficient to its projected needs.

4.0 PROBLEM STATEMENT

Because of these deficiencies, it is not likely that the 1985 Army will have an adequate communications capability unless strong action is taken now to refocus several hardware development programs and take new initiatives in other areas. The needed actions will be outlined at the end of this report.

Part Two
Current Communications

CURRENT COMMUNICATIONS



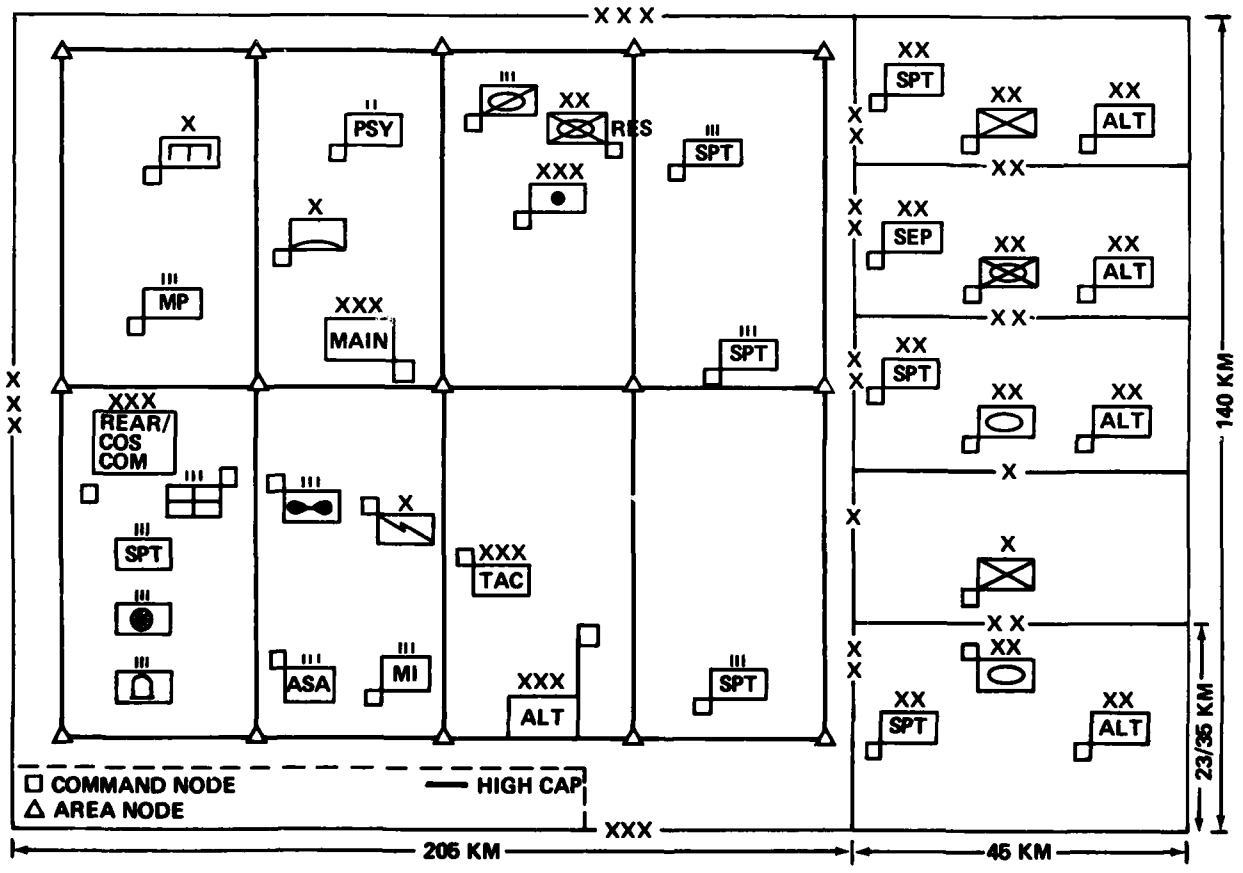
5.0 *CURRENT COMMUNICATIONS - A TYPICAL CORPS*

The Army's current tactical communications capability may be broken into multichannel and single channel components. The multichannel component will be described first.*

This chart shows a typical corps deployed over a 250 x 140 square kilometer area. It includes key subordinate elements in the corps rear area, including a reserve mechanized infantry division, and maneuver elements in the forward area comprised of two armoured divisions, a mechanized infantry division, an infantry division and a separate infantry brigade.

*The charts used to depict multichannel communications originally appeared in The Army Tactical Communication System (ATACS): Description of the Army Tactical Communication Assemblages and Equipment, Department of the Army, Project Manager, ATACS, Fort Monmouth, New Jersey, 1 January 1974.

CURRENT COMMUNICATIONS



6.0 CURRENT COMMUNICATIONS - CORPS AREA HIGH CAPACITY MULTICHANNEL*

The black "grid-like" structure shown throughout the corps area comprises the corps' high capacity "backbone" microwave radio relay system. Doctrine calls for fifteen area nodes, each one of which consists of many vans of telephone terminal, switching, radio relay, technical control and teletype equipment. A typical node is shown in Appendix I. The high capacity system (48/96 channel) uses the AN/TRC-138 terrestrial line of sight (LOS) radio assemblage which can support 48 duplex** voice channels or 96 simplex** voice channels. The system is pre-sited, operated and maintained by a Signal Company of the Corps Signal Brigade. During wartime area nodes "leap frog" as the corps moves. That is, several nodes disconnect, move forward (or to the rear) to preselected sites, set up, and reestablish links with the network. Set up and tear down times range from 30 minutes to several hours depending on equipment reliability, skill of operating personnel and terrain features. As a whole, the corps area network is relatively immobile; however, it can adjust via this "leap frog" technique.

This "backbone" system provides the many thousands of corps area users with a switched telephone system for voice, teletype; and facsimile traffic.

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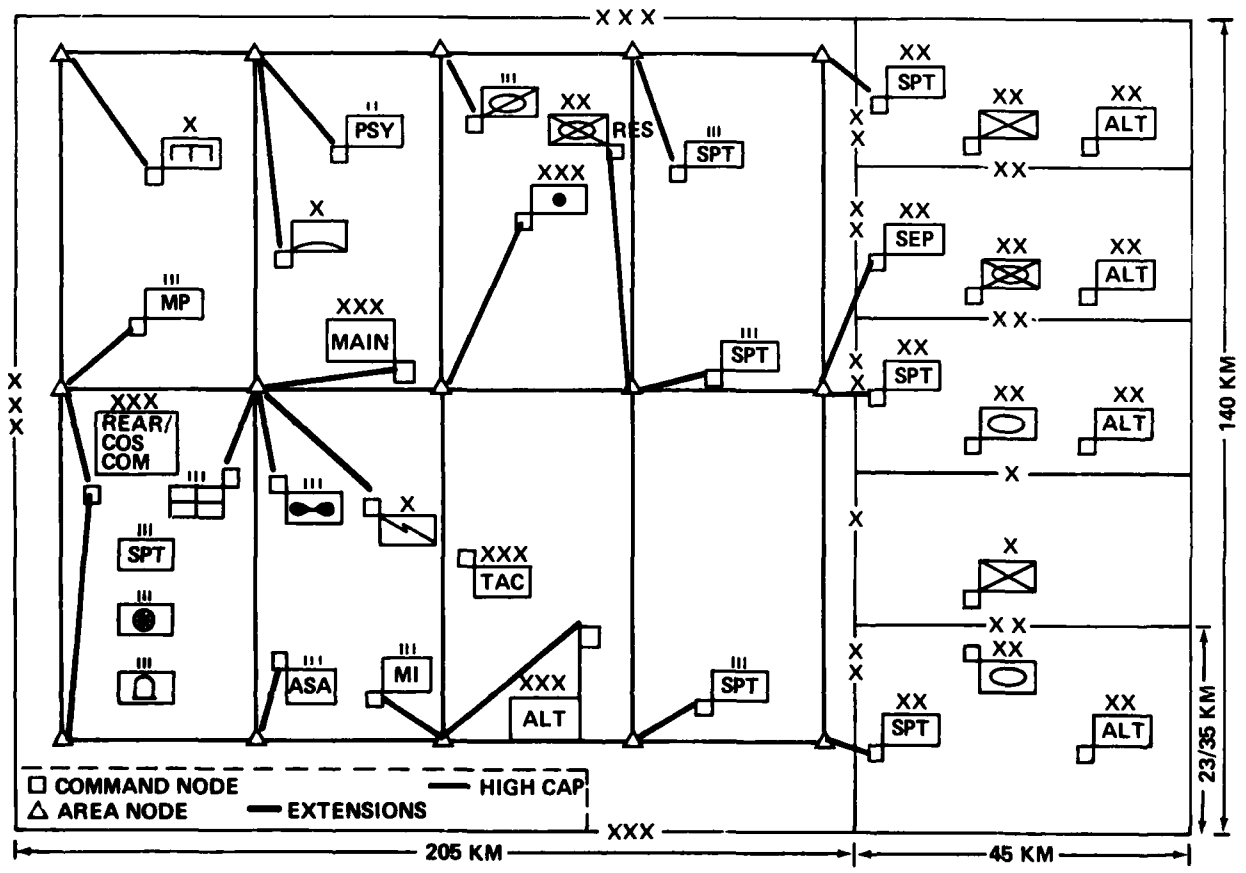
*The Project Manager, Army Tactical Communications System (PM, ATACS) is the developer of all multichannel equipment.

**"Duplex" voice channels are two-way channels.
"Simplex" voice channels are one-way channels.

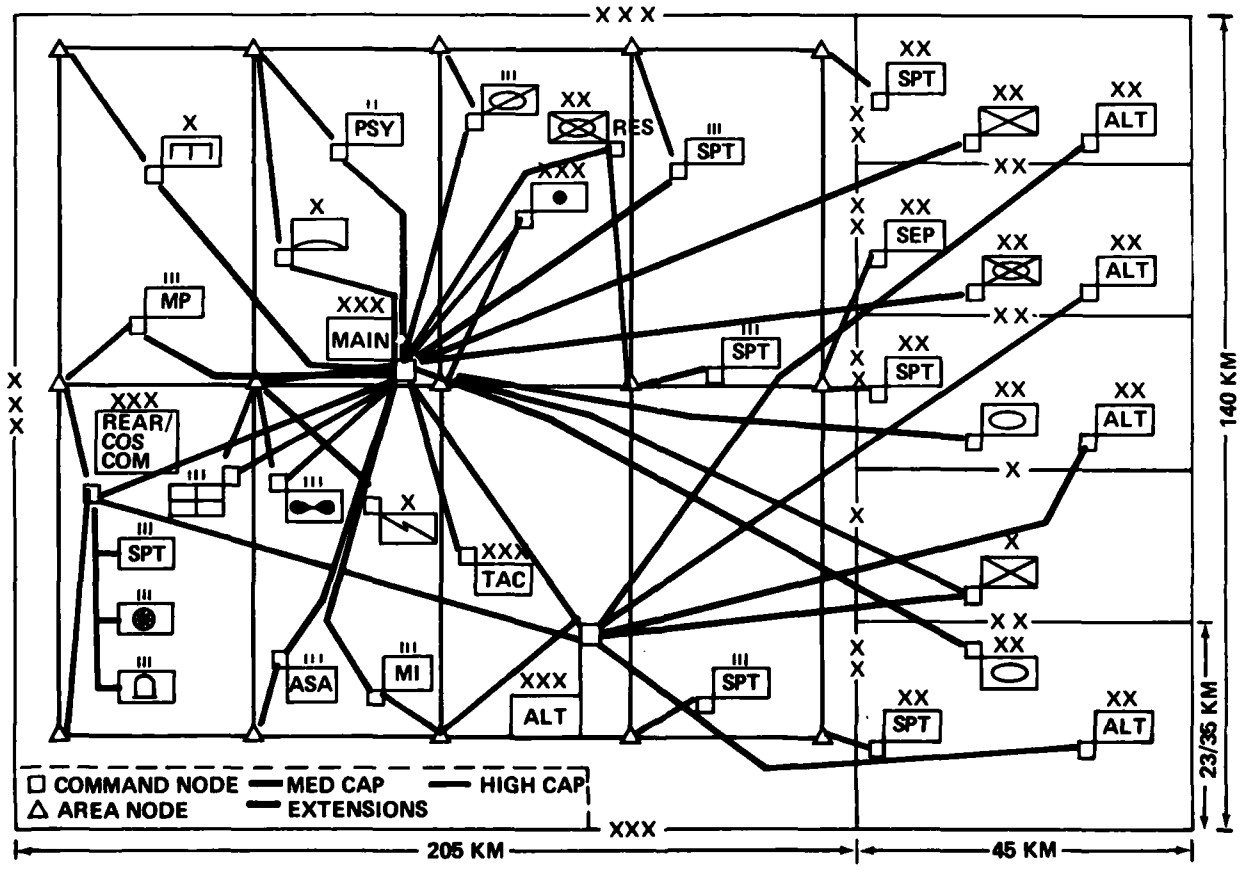
CURRENT COMMUNICATIONS



7.0 CURRENT COMMUNICATIONS - CORPS AREA MULTICHANNEL EXTENSIONS

Medium capacity (12/24 channel) line-of-sight extensions link each major corps subordinate command and the support elements of the combat divisions to the high capacity backbone system. This permits individual elements to move about with no disruption to the backbone system although tear-down and set-up time for the unit terminus of the extension would keep the unit temporarily out of contact with the system. The primary extension equipment includes the AN/TRC-151 or AN/TRC-152 assemblage which uses versions of the AN/GRC-50 (v) radio operating in the UHF and microwave regions. This radio uses highly directive (narrow beam width) antennas that must be aligned after a move. This is usually a lengthy process.

CURRENT COMMUNICATIONS



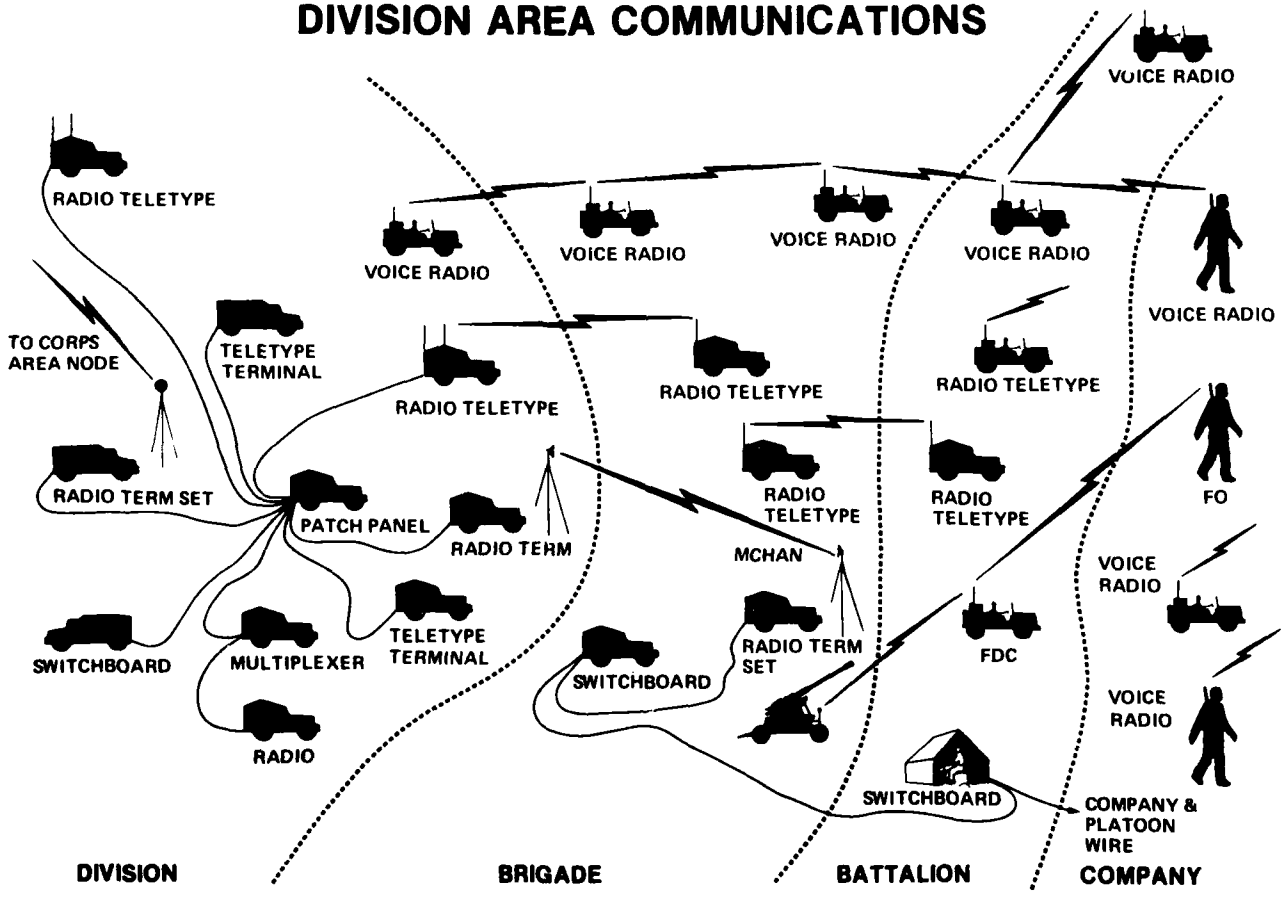
8.0 CURRENT COMMUNICATIONS - CORPS COMMAND MEDIUM CAPACITY MULTICHANNEL

The corps also has medium capacity (12/24) multichannel command links to key corps area subordinate elements as well as to the attached divisions and separate brigade. Command links from the corps alternate headquarters to the attached divisions and separate brigade are also installed in the event the main corps headquarters is unable to control tactical operations. The primary equipment assemblage used for these command links includes the AN/TRC-110 and AN/TRC-117 which also use the AN/GRC-50 (v)2 radio series. A new radio (AN/GRC-103, Band IV) incorporating the latest microcircuitry will replace the AN/GRC-50 series in the near future.

Multichannel communications are also used throughout the division area, although these are not shown. These consist of interconnected low capacity (6/12) links between the main and alternate division headquarters, and each of the maneuver brigades, as well as between signal centers, aviation battalions, air defense artillery battalions and the division artillery headquarters.

The corps also has available tropospheric scatter equipment (AN/TRC-121 and AN/TRC-112) to establish multichannel (12/24) links between corps and division areas without relying on the intermediate repeaters needed with terrestrial LOS communications. This equipment uses the AN/GRC-143 which operates in the 4.5 - 5.0 Ghz frequency range. In practic very little use is made of this troposcatter equipment.

DIVISION AREA COMMUNICATIONS



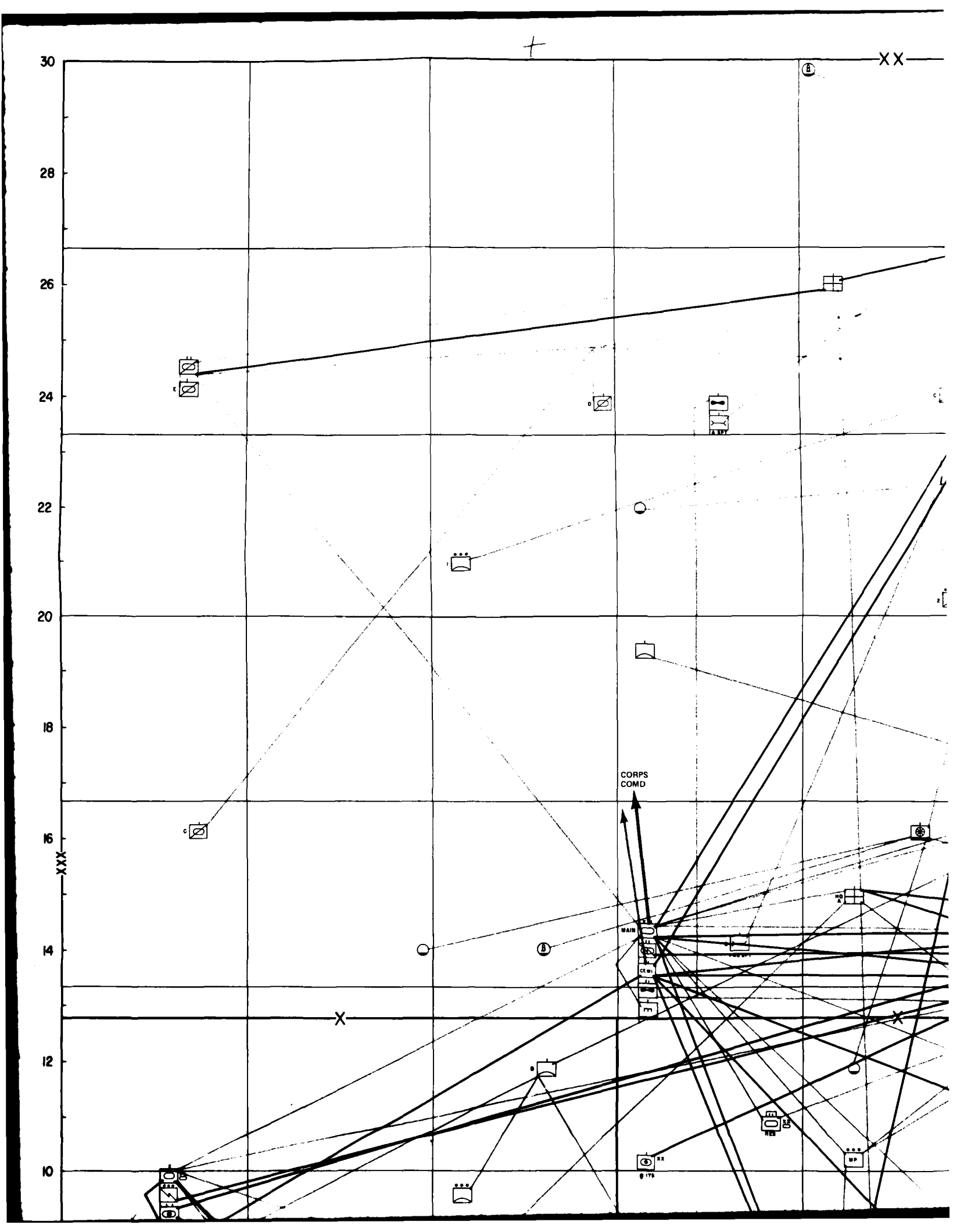
9.0 DIVISION AREA COMMUNICATIONS

The communications typically found in a division area include: multichannel radio from division to brigade and from division to the corps area system; man-portable and vehicular VHF/FM voice net radio such as the AN/PRC-25/77 and AN/VRC-12 series respectively; and HF radio teletype for administrative/logistics and operations/intelligence traffic. These various types are stylistically depicted in the accompanying chart.*

The equipment-intensive nature of multichannel radio, as well as the heavy reliance on wire sometimes found down to the company level, contributes to the relative immobility of division area communications.

The field artillery relys on VHF/FM net radio for passing targeting information from one of many forward observers (FO) via a battalion fire direction to a firing battery (e.g., 155mm self propelled or towed howitzer).

*This chart is an augmented version of a chart originally appearing in The Army Tactical Communications System (ATACS): Description of Army Tactical Communication Assemblages and Equipment, op. cit.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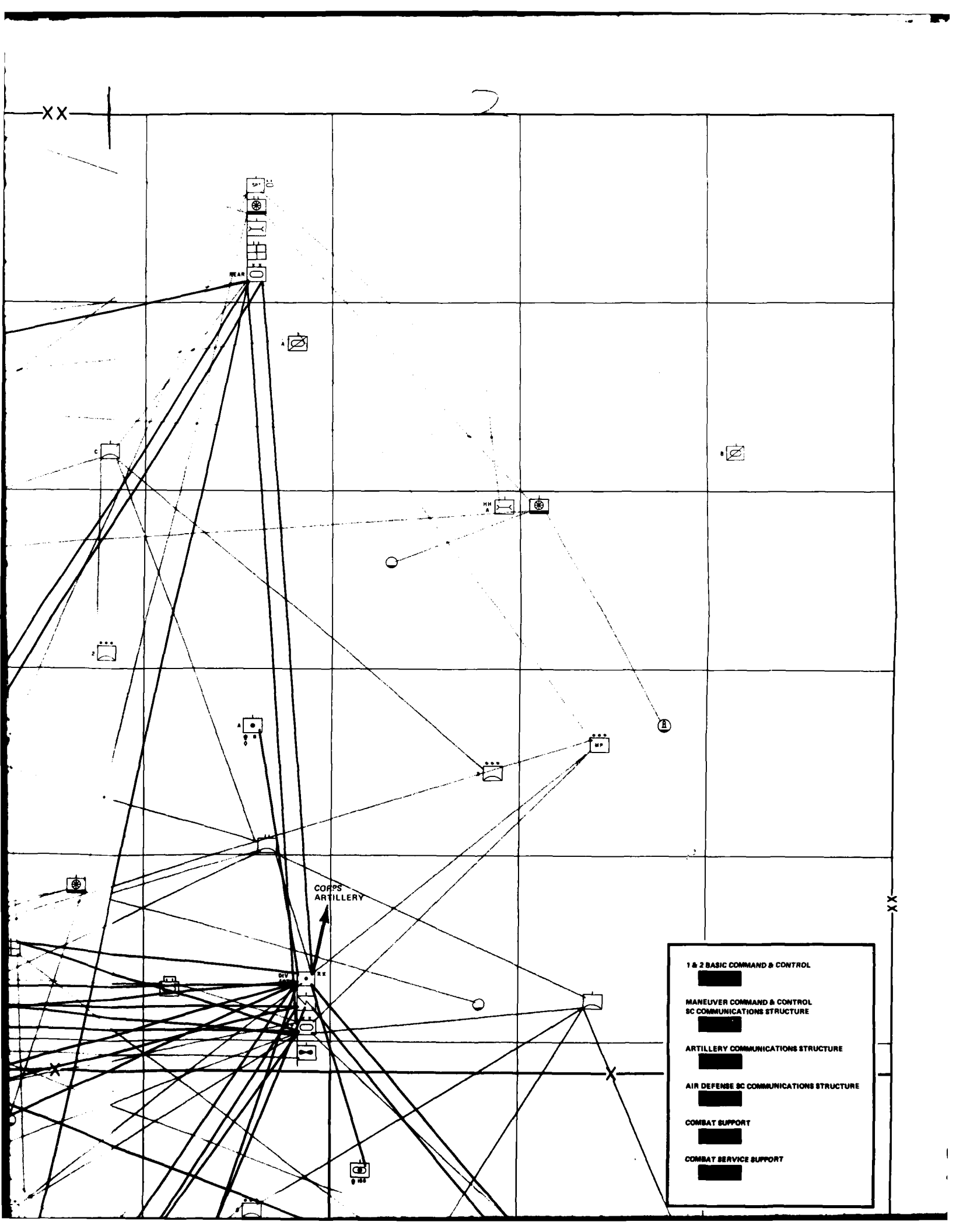
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MANEUVER COMMAND & CONTROL
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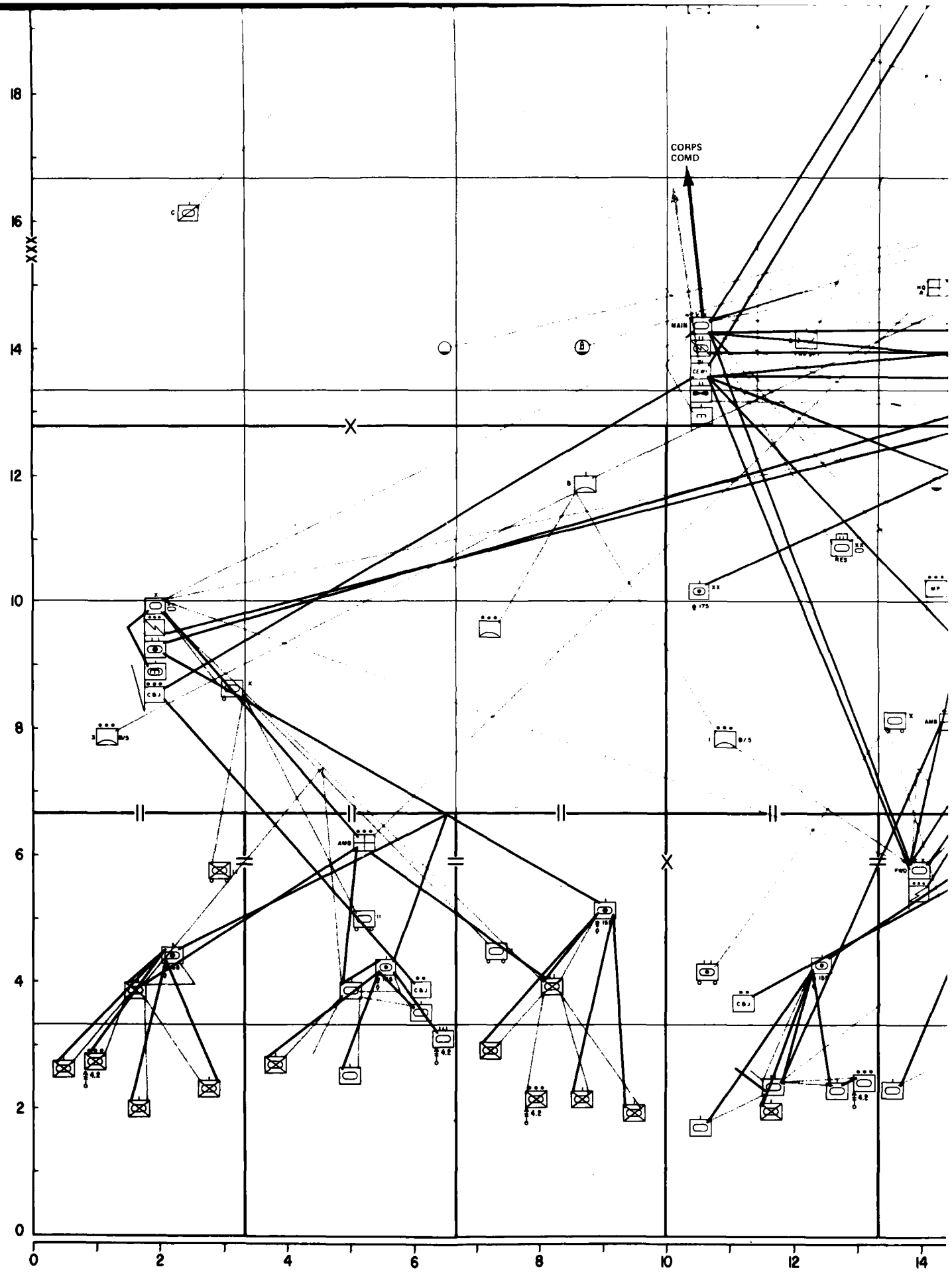
ARTILLERY COMMUNICATIONS STRUCTURE
AIR DEFENSE SC COMMUNICATIONS STRUCTURE
COMBAT SUPPORT
COMBAT SERVICE SUPPORT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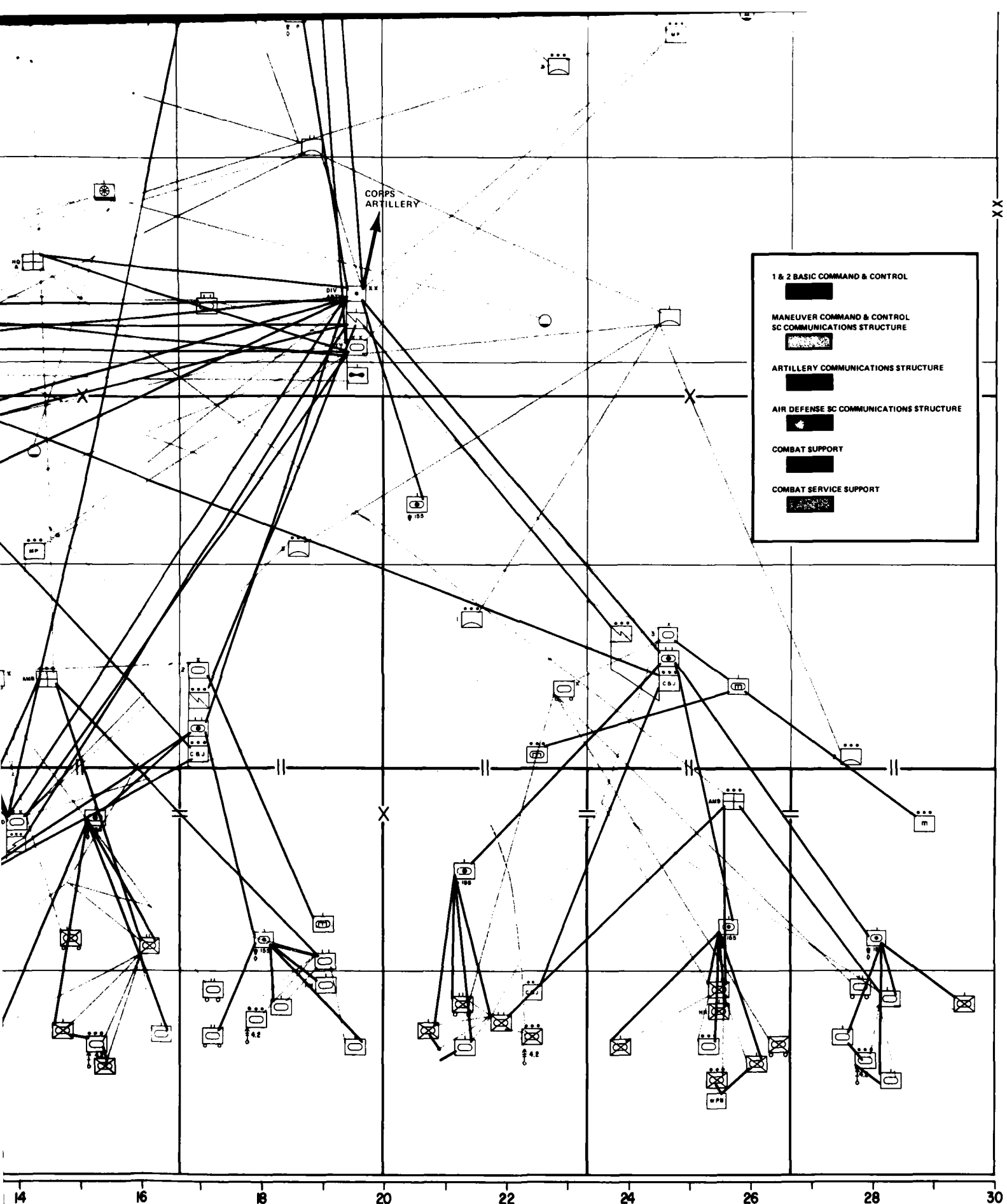
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AIR DEFENSE SC COMMUNICATIONS STRUCTURE
COMBAT SUPPORT
COMBAT SERVICE SUPPORT
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4

10.0 DIVISION SINGLE CHANNEL COMMUNICATIONS

The primary means of communications within a division is single channel VHF/FM combat net radio. A typical division will have as many as 2600 separate radios operating on upwards of 350 separate nets. The vehicular (tank, APC, jeep) AN/VRC-12 and AN/VRC-46 series and the man-pack AN/PRC-25/77 series comprise most of this equipment.

A typical armored division with all its units is shown deployed over a 30 x 30 square kilometer area. In addition to the division command and control net shown in red, the division's maneuver command and control nets to forward combat elements (pink), field artillery nets (dark blue), air defense nets (light blue), combat support nets (dark green) and combat service support nets (light green) are shown. Not shown are the administrative/logistics and operations/intelligence nets for each of the subordinate units which would parallel the structure shown here.

Some of the information transmitted over these nets is digital data and much is amenable to conversion to digital form. For example, the artillery currently uses existing VHF/FM net radio to distribute fire requests from Forward Observers to the Fire Direction Center (FDC) via the Fire Support Coordination Center (FSCC). The FDC uses the same medium to pass the fire mission to individual firing batteries. The Digital Message Device and other components of the computer-based TACFIRE system are beginning to come into use and will increasingly replace voice messages with data in digital format. Unless strict net discipline prohibiting voice transmission over this net is maintained, the digital data stream will be disrupted by voice transmission.

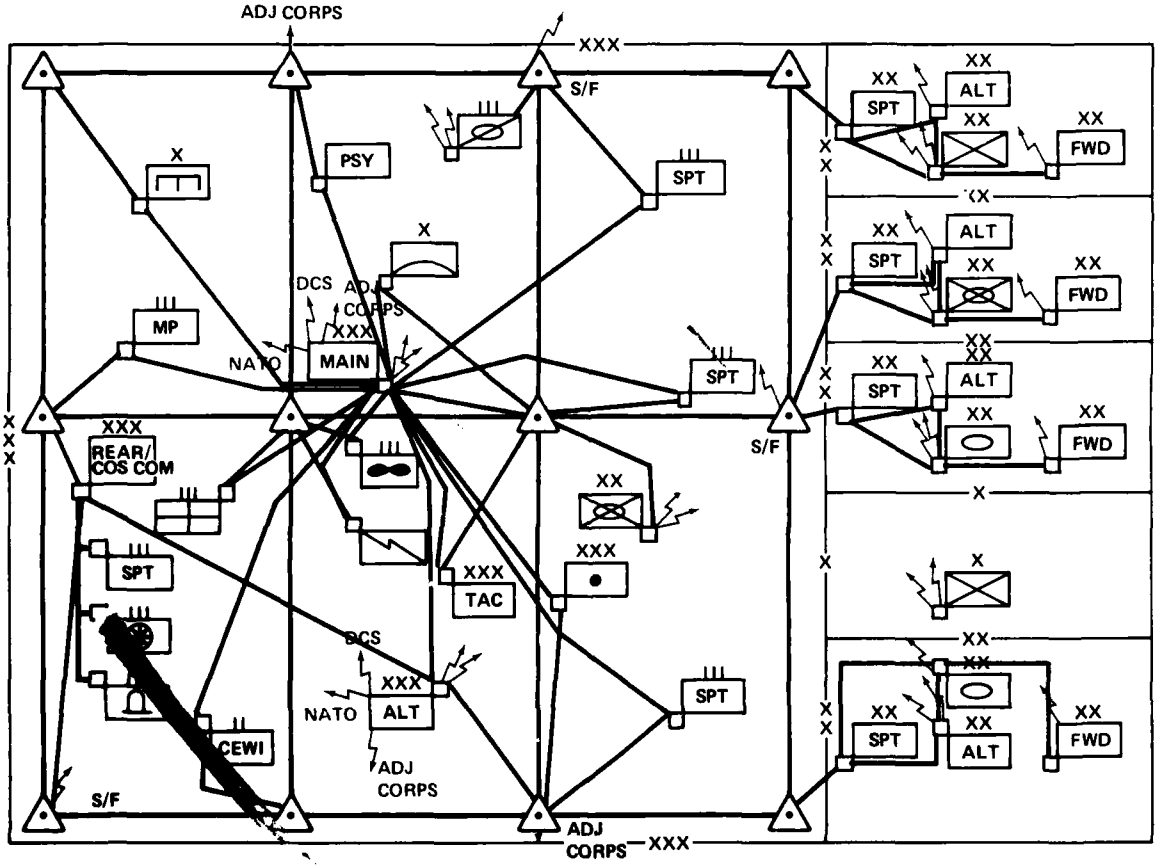
Other data now transmitted by voice are clearly amenable to conversion to digital format. Included in this are situation reports, some spot reports, supply requests and other administrative/logistics traffic.

There is increasing awareness of the data-intensive nature of much of the traffic currently being handled over single channel combat net radio. Preliminary analyses at CACDA and the Signal School indicate that the proportion of traffic that is, or could be, transmitted as digital data may be as high as 65%. Clearly, if this is so, a tactical information data system, designed to handle such information systematically, might prove to be more efficient, faster, and more economical than the present system.

Part Three
CORCOM 85

CORPS COMMUNICATIONS NETWORK FOR 1985

(THE TREND)



NOTES
1. AREA & COMMAND SYSTEMS REPEATERS NOT SHOWN
2. LIMITED USE OF SINGLE CHANNEL TACSATCOM NOT SHOWN
3. SINGLE CHANNEL VHF/UHF/HF RADIOS NOT SHOWN
4. DEDICATED ISTA, ADA, ETC LINKS NOT SHOWN

11.0 CORPS COMMUNICATIONS NETWORK FOR 1985 (THE TREND)

Current Army planning and hardware development programs will result in a 1985 corps communications capability similar in overall appearance to the current capability. This is because complete transition to the INTACS-defined "Objective System", which calls for a total consolidation of the corps command and corps area multichannel radio systems, will not be possible by the 1985 timeframe. Individual items of equipment will change, and new capabilities such as satellite multichannel ground terminals and mobile subscriber equipment (MSE) will be introduced. There may also be some modifications to the network as a whole. However, the thrust of current Army thinking and development is basically similar to the current, redundant corps area and command multichannel radio networks.

There will be continued reliance on high capacity terrestrial multichannel radio with extensions for the backbone system, although this will lessen as transition to the Objective System proceeds. The TRI-TAC AN/TTC-39 analog/digital circuit switch will have replaced some of the current AN/TTC-38 analog switches as the gradual evolution to an all digital architecture begins. Also, several of the nodes will incorporate the TRI-TAC/TYC-13 digital message switch for store-and-forward (S/F) operations. There is, however, no planned alternative to reliance on terrestrial multichannel radio within the division down to the brigade level by 1985. This will be particularly troublesome as the need for greater mobility increases.

There will be limited introduction of multichannel satellite communications at division main, forward and alternate headquarters; separate brigade headquarters; corps main and alternate headquarters;

and at selected area nodes. These installations (indicated by the red arrows) consist of the AN/TSC-85 (V)2 and AN/TSC-93 satellite ground terminals housed in transportable S-280 shelters and are now under development by the U.S. Army Satellite Communications Agency (SATCOMA). They will operate in the SHF band using the planned DSCS-III satellites. Although the Army will make some use of single channel satellite terminals, they will be given to special forces and airborne rangers and will not be part of a typical corps communications assets by 1985. These terminals consist of the man-pack AN/PSC-1 and vehicular AN/MSC-65 which will use either the Navy sponsored fleet satellite communications transponder or planned General Purpose Satellite Communication System (GPSCS) satellites and will operate in the UHF band.

There is some question as to the availability of adequate space segments (DSCS-III and GPSCS) by 1985. This might explain the limited introduction of a new capability which has great potential for relieving the mobility constraints inherent in conventional terrestrial line-of-sight communications.

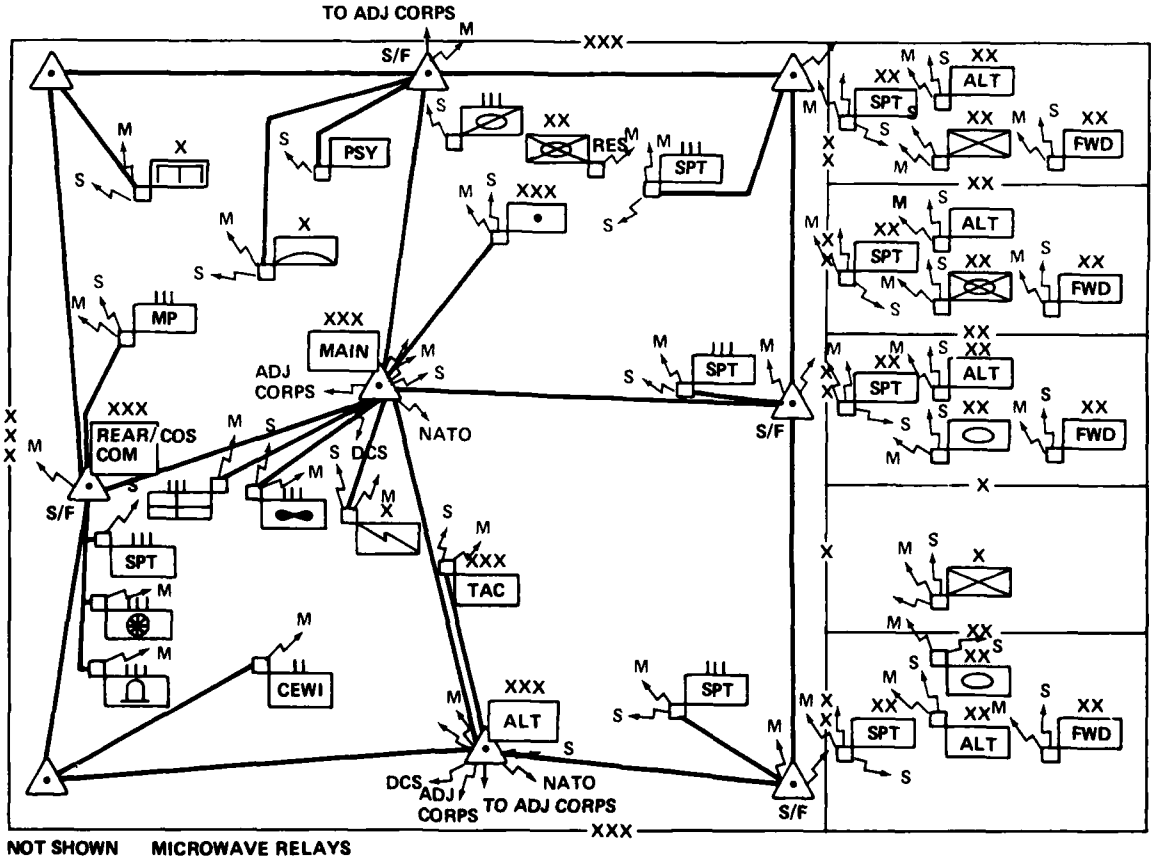
The TRI-TAC digital tropospheric scatter radio (AN/TRC-170) will probably replace the current equipment using this technique. The location of these radios is indicated by the black arrows on the accompanying chart.

In summary, the trend - as manifest in planning and hardware development - is for a continuation, with some updating and new equipment introduction, of the current capability. This trend will result in some improvement in mobility, but it does not integrate communication

needs of such developing tactical data, intelligence, surveillance and target acquisition systems as TOS, TACFIRE, AN/TSQ-73 (MISSILEMINDER), SOTAS, GSR, FIREFINDER (AN/TPQ-36/37), MULTEWS, AGTELIS, etc.

Although not specifically shown, it is anticipated that single channel communications will be very much the same in 1985 as they are today.

CORPS COMMUNICATIONS NETWORK FOR 1985
(AN ALTERNATIVE)



12.0 CORPS COMMUNICATIONS NETWORK FOR 1985 (AN ALTERNATIVE)

There is a need to re-orient the thrust of Army tactical communications away from its current and projected voice-intensive nature. Also, the constrained mobility of terrestrial multichannel radio should be relieved. This re-orientation must be accomplished within the framework of a new tactical communications architecture which recognizes the increasing need of the modern Army for digital data, and the continued foreseeable need for voice communications. CORCOM 85 is this new architecture. It introduces a concept for assured command and control communications: terrestrial multi- and single channel communications, multi- and single channel tactical satellite communications (TACSATCOM) and a tactical information distribution system (TIDS). More will be said about TIDS later.

The terrestrial multichannel and TACSATCOM components for a typical corps are shown in the accompanying chart. This alternative approach consolidates the corps area and command multichannel systems shown earlier into one high capacity switched telephone trunking system (heavy black lines) for voice and record traffic with medium capacity extensions (green) for local dispersed users. This consolidation reduces the number of area nodes to nine and eliminates all terrestrial multichannel radio within the divisions and separate brigade. It also provides, as shown by black arrows, troposcatter terminals (AN/TRC-170) at division rear and separate brigade headquarters, forward area nodes, corps main and corps alternate headquarters. These same locations can also communicate in a line-of-sight mode. Also, lateral LOS and troposcatter links to adjacent corps are provided. This consolidation recognizes the need to make effective use of existing multichannel equipment, some of which is almost

ready for deployment to the field. It also recognizes the Army's commitment to TRI-TAC, through which the Army will gradually evolve an all digital architecture from the existing/developing analog multichannel equipment.

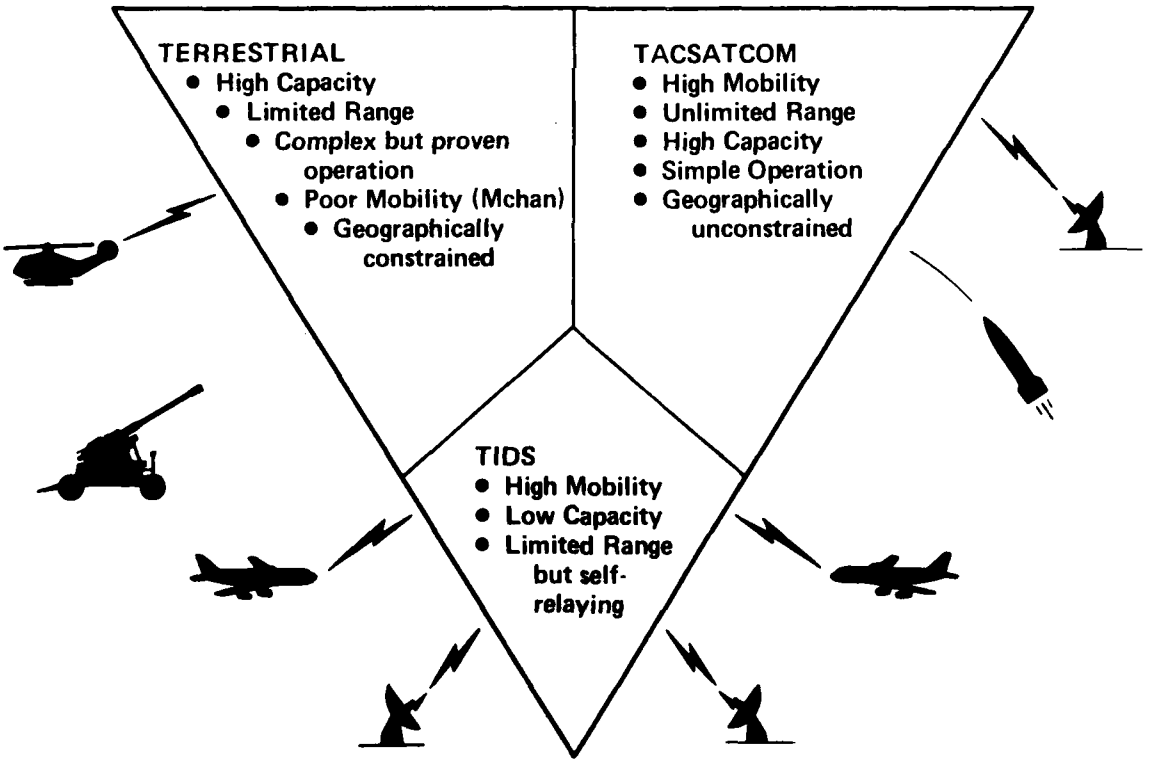
The TACSATCOM component of the triad comprises both multi- and single channel ground terminals. Satellite ground terminals such as the AN/TSC-85(V)2 and AN/TSC-93 (red arrows with M), in conjunction with the planned DSCS-III satellites, provide the divisions and separate brigade with high capacity demand assigned, time division multiple access (DA/TDMA) multichannel communications instead of terrestrial LOS multichannel equipment. Multichannel satellite ground terminals are also at corps subordinate unit headquarters thoughtout the corps area and at selected corps area nodes. The multichannel satellite ground terminal equipment is interoperable with the terrestrial LOS and troposcatter multichannel equipment. This increased use of multichannel satellite communications means greater mobility for the forward maneuver elements as well as moderate anti-jam protection afforted by the DSCS-III's planned use of null steering antennas.

Single channel DA/TDMA man-portable and vehicular TACSATCOM terminals (red arrows with S) which will use the planned joint General Purpose Satellite Communications System for relay provide key subscribers within the attached divisions and separate brigade, as well as corps area users, with a highly mobile but low capacity communications capability.

Not shown is a streamlined single channel VHF/FM net radio capability that would be used primarily by the forward manuever elements within a division or separate brigade and linked to combat operations where the need for unstructured, dynamic "give and take" voice communications is greatest.

CORCOM 85

THE TACTICAL COMMUNICATIONS TRIAD FORCES THE ENEMY TO MULTIPLE ECM AND TARGETTING SCHEMES



13.0 THE TACTICAL COMMUNICATIONS TRIAD FORCES THE ENEMY TO MULTIPLE ECM AND TARGETING SCHEMES

Communications are vital to command and control on the modern battlefield. The commander must be assured that he can communicate where, when and with whom he pleases. The Soviets recognize the importance of timely, effective command and control communications. Their stated intention is to disrupt, deny or destroy an adversary's vital communications links. Since no single capability can be relied on to provide assured communications, there is a need to provide a communications mix that would force the enemy to expensive multiple ECM and targeting schemes.

This chart depicts the elements of CORCOM 85, important features of each component and their susceptibility to three mutually exclusive enemy electronic warfare and targeting capabilities.

The U.S. Army currently relies solely on terrestrial communications which are susceptible to conventional and increasingly effective electronic countermeasure, direction finding and emitter location technologies.

Terrestrial communications have a relatively high capacity, but poor mobility and limited range (without pre-planned relaying). They are ill-suited to the dynamic information transfer requirements of the modern battlefield.

The second component, TACSATCOM, represents close to the ideal in military communications if a potential enemy does not have the weapons, time or inclination to interfere with them. TACSATCOM has high capacity, is relatively mobile and simple in operation, is unconstrained geographically and is therefore not subject to the vagaries and exgencies associated with electromagnetic propagation over hilly terrain and through vegetation.

The third component, TIDS, would be hard to destroy as a whole or in significant numbers because it is organic to the user and does not require large equipment complexes for transmission, multiplexing or switching. From an EW viewpoint it presents a widely dispersed target array to enemy high power airborne or ground-based jammers, either of which would be vulnerable to counter attack. TIDS would be difficult to destroy by some form of emitter location and targeting because of its low probability of intercept (LPI) radio frequency (RF) signature and relatively short burst duration. The TIDS terminals are mobile and the system can achieve extended range by virtue of its unique self-relaying capability, although it has relatively lower capacity.

Each component of the triad provides a different level of communications capability. Each one individually could meet the commander's C^2 needs to different levels of effectiveness. Together they provide an assured C^2 capability.

In summary, this alternative approach would provide the Army with a flexible, responsive, effective communications capability. It would initiate the shift away from voice intensiveness, at a crucial and opportune time in the development cycle of key programs such as SINCGARS, TACSATCOM and TRI-TAC, and it would incorporate an emerging technology which could revolutionize battlefield communications.

Part Four
TIDS

CORCOM 85

TACTICAL INFORMATION DISTRIBUTION SYSTEM

- Worry-free essential communications network
  - Highly mobile
  - "Jam Proof" and survivable
  - Self-relaying
- General purpose for diverse user groups
  - All army systems
  - Man-to-computer, computer-to-computer
  - Sensor and intelligence report distribution
  - Command and control
  - Position location
  - Record traffic
- Initiates shift from voice-oriented operations
  - UHF/microwave multichannel links
  - VHF/FM net radio
  - Voice/data contention
- Interoperable with terrestrial multichannel and TACSATCOM
  - Hybrid switches
  - IMPS, TIPS
  - AUTODIN

14.0 TACTICAL INFORMATION DISTRIBUTION SYSTEM

Technology is rapidly changing the character and pace of conventional warfare. Intelligence, surveillance, and target acquisition sensors are extending the commander's ability to see the battlefield and predict the enemy's next moves. Precision guided munitions enable him to strike beyond the range or accuracy of conventional firepower. Increased mechanization on the ground, use of assault helicopters and coordination with the Air Force's close air support and battlefield interdiction assets make possible highly mobile, combined arms operations with concentrated firepower.

The impact has been to impose new demands on the commander's command and control system. It must adapt where it can, change where it cannot and expand as the need arises. A potential opportunity for change is represented by microprocessor-based burst communications technologies which make possible a tactical information distribution system.

In concept a TIDS offers the commander a worry-free network for his essential communications - one that doesn't require advance siting, complex transmission and switching equipments, special relays or dedicated personnel for installation and operation. It would be highly mobile and self relaying; that is, messages would be automatically relayed throughout the system, across the battlefield to the intended recipient with no special switching nodes or human intervention.

TIDS would be a general purpose system suitable for diverse users among all the TRADOC defined Army systems. More will be said on this later. It would automatically distribute sensor and intelligence reports, situation reports (SITREPS), supply and maintenance requests and record traffic to as many or as few recipients as desired. It could be used for man to man, man to computer and computer to computer communications.

TIDS would be interoperable with terrestrial multichannel TACSATCOM and AUTODIN via hybrid switches. For certain TIDS technologies, interface message processors (IMPS) or terminal interface processors (TIPS) may be required.

Adoption of TIDS would initiate the shift away from voice oriented operations exemplified by current UHF/microwave multichannel links and VHF/FM net radio and would eliminate existing and potential voice/data contention problems arising from the use of voice-oriented systems for mixed voice/data communications. It would offer a new way to distribute information from and among highly automated battlefield systems.

WHY TIDS?

- Revolutionary Technology - A Totally New Capability
  - Self-relaying
    - Timely, automatic battlefield information transfer
    - Real-time command and control
  - Position location
  - High anti-jam

- New Opportunities - Equipment, Organization, Doctrine
  - Organic switching/transmission
  - Decentralized message processing/distribution

- The Push and Pull of Technology

15.0 WHY TIDS?

The rationale for TIDS is threefold.

First, through revolutionary technology it offers the potential for a totally new battlefield communications capability. Because of its unique self-relaying feature, real-time command and control, and timely, automatic battlefield information transfer are possible. It provides inherent, accurate position location and has a built-in, high anti-jam capability by virtue of its transmitted waveform.

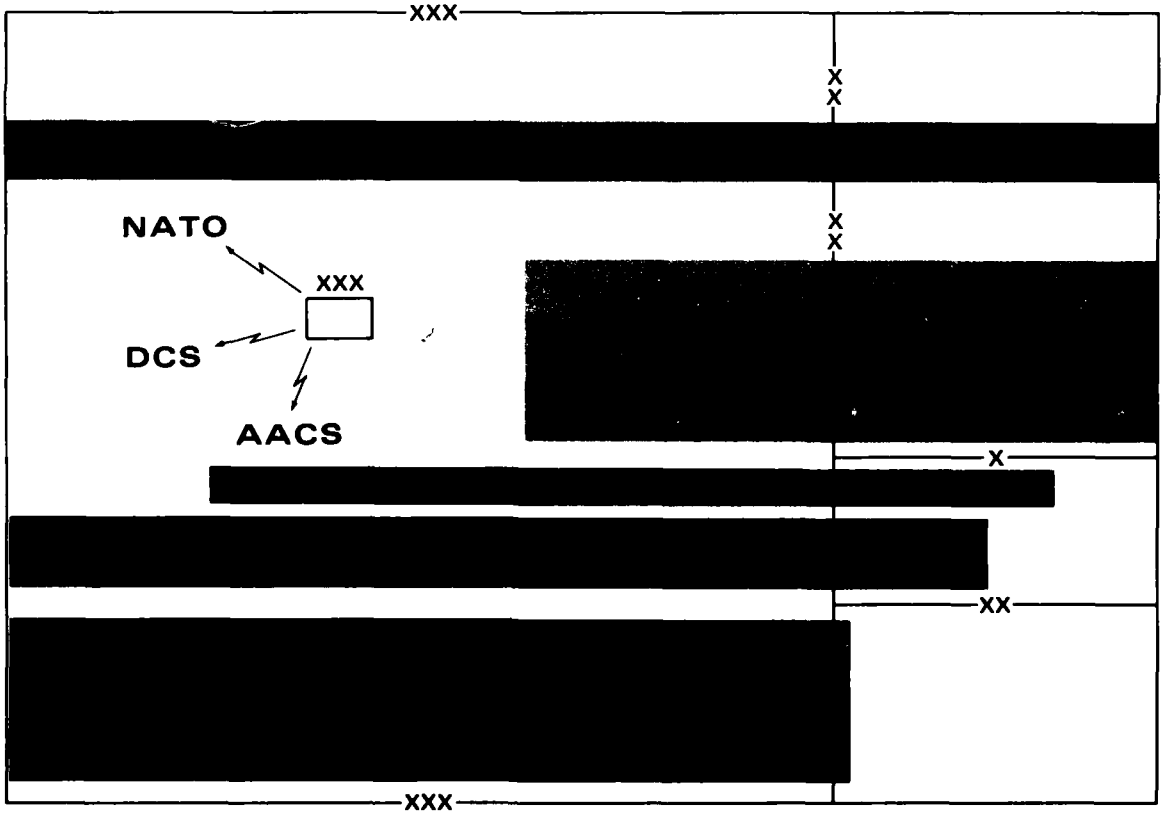
Secondly, TIDS may offer new equipment, organizational and doctrinal opportunities. Because the switching and transmission functions are organic to each terminal, TIDS equipment would be less complex and cumbersome. It could permit decentralized "writer-to-reader" message processing and distribution, thus alleviating message center congestion. It could make possible doctrinal change or evolution. Intelligence and target information could be distributed simultaneously to many users for immediate action. It could permit automatic aggregation and transfer of SITREPS up the chain of command.

Thirdly, and perhaps most importantly, it may make possible new operational concepts. This has to do with the observed phenomenon, that not only does new technology push to improve old ways of doing things, but it also pulls new requirements along, opening up new opportunities and new ways of doing things.

For example, a TIDS deployed throughout the division area, even up to the forward maneuver elements, could allow a division commander to "blink" many, small, low power, communications jammers organic to each tank or APC across a selected portion of the FEBA. There would be no need to pass such an order down the chain of command or to have a dedicated link.

The next series of charts outlines a projected use of TIDS by the Army in the 1985 time frame within the overall CORCOM 85 triad architecture.

FUTURE BATTLEFIELD COMMUNICATIONS



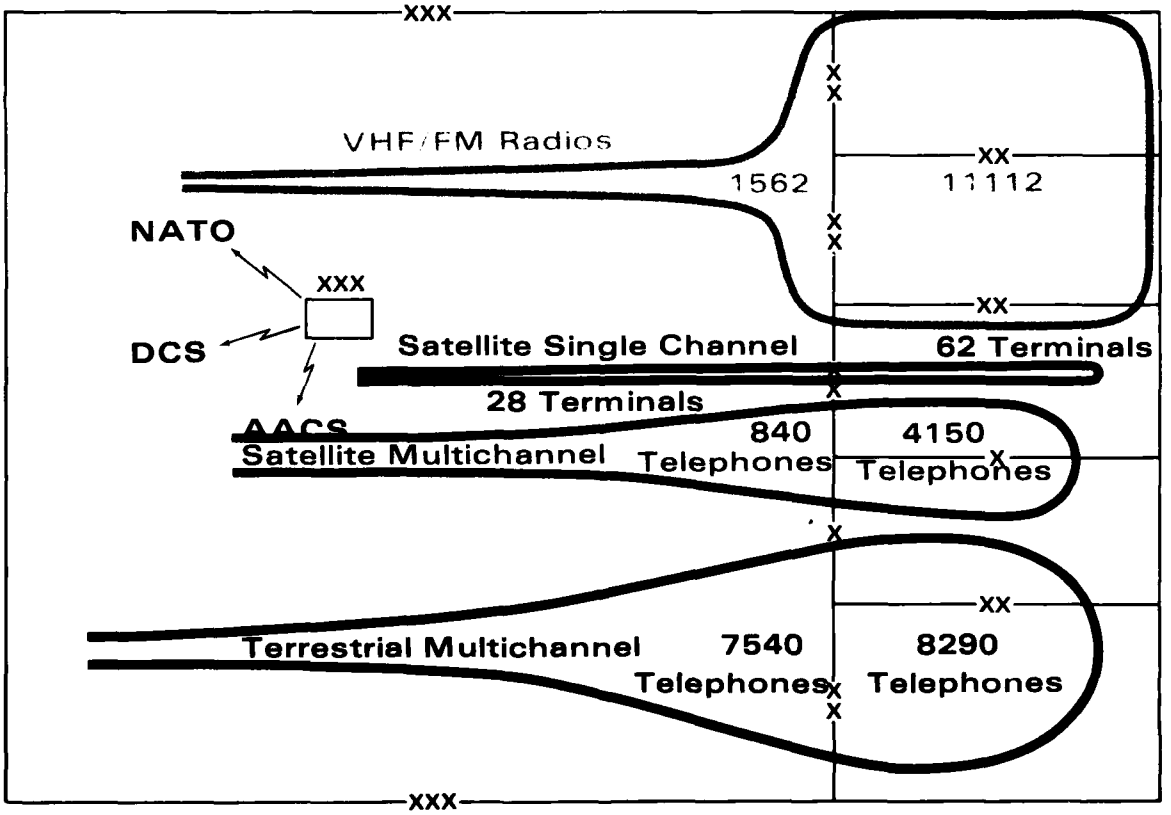
16.0 FUTURE BATTLEFIELD COMMUNICATIONS

The CORCOM 85 architecture envisions a mix of communications capabilities throughout a typical corps in 1985. The elements of this mix are shown by area of use within a typical corps in the accompanying chart. The width of the color bars indicates the rough relative magnitude of this use. Thus, TIDS will have broad applicability within both the division and the corps; single channel, terrestrial radio (SINCGARS) will be seen throughout the division and in forward corps area elements; single channel satellite ground terminals will be used throughout the corps and down to the battalion level in the division; multichannel satellite ground terminals will be widely used throughout the corps and down to the brigade echelon within a division; and terrestrial multichannel radio will be widely used in the corps area and to limited extent in the division rear areas.

The NATO, Defense Communication System (DCS), and Army Area Communication System (AACS) interfaces at the corps main headquarters provide access to strategic and theater communications assets.

This mix prescribes the CORCOM 85 conceptual architecture for future battlefield communications. The next two charts project the number and likely distribution of the communications equipment throughout a corps, as they will be if the current trend continues and as they would be under the CORCOM 85 concept.

FUTURE BATTLEFIELD COMMUNICATIONS: THE TREND

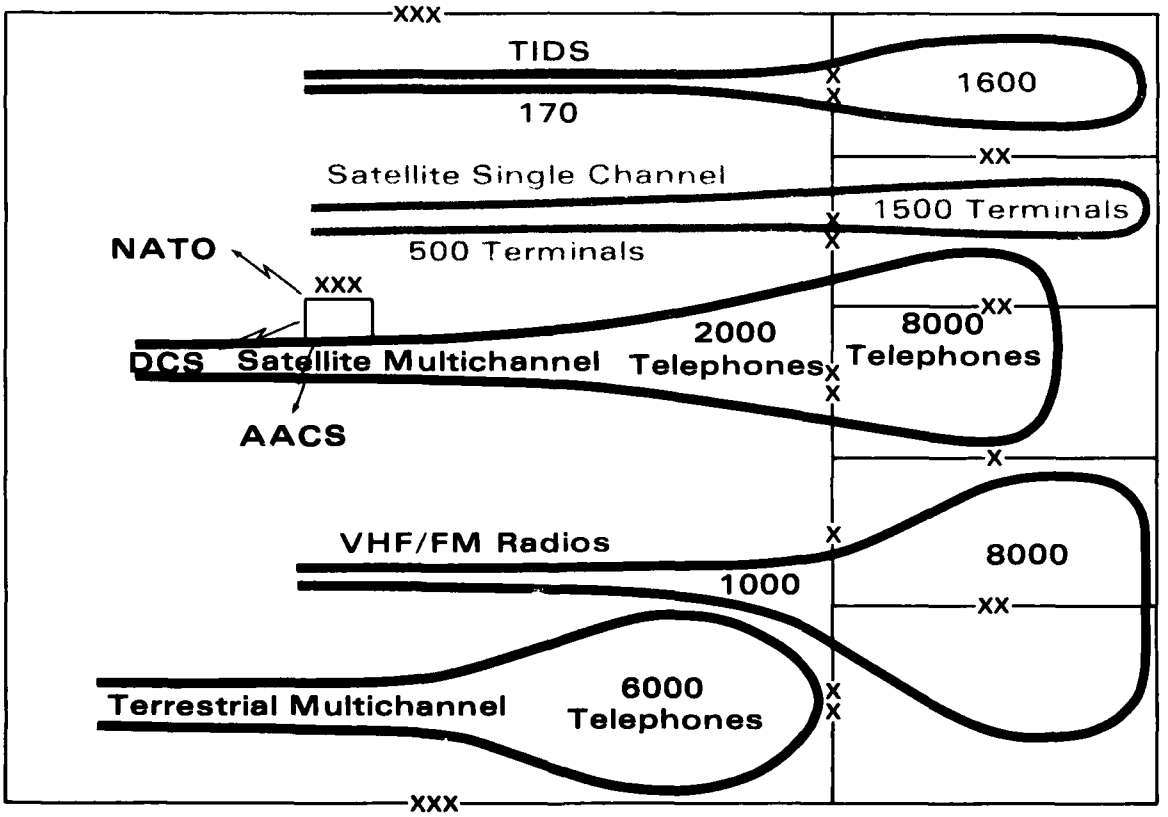


17.0 FUTURE BATTLEFIELD COMMUNICATIONS: THE TREND

The current thrust of tactical communications planning and hardware development suggests an equipment mix for 1985 something like that shown on the accompanying chart. The numbers on this chart are based on the INTACS Study Objective System Final Report.
The chart is color-keyed to the previous chart. The heavy commitment to terrestrial single and multichannel radio particularly in the division is evident. The continued reliance on the immobile multichannel radio down to the brigade level is particularly troublesome because of the unavailability of an alternative. The chart shows that the introduction of multichannel satellite and, to a lesser extent, single channel satellite communications will relieve the mobility constraints for about 1/3 of the total telephone subscribers within a division.

The large number of VHF/FM voice radios does not reflect the fact, alluded to earlier, that most of the traffic on these radios is amenable to transmission on a burst communications network such as TIDS.

FUTURE BATTLEFIELD COMMUNICATIONS: AN ALTERNATIVE



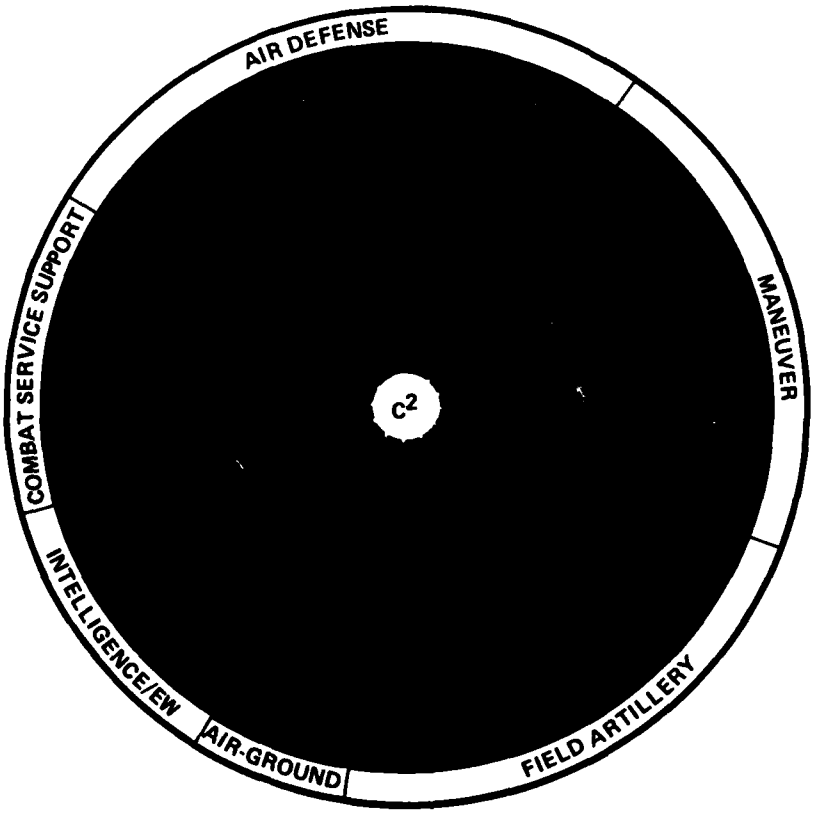
18.0 FUTURE BATTLEFIELD COMMUNICATIONS: AN ALTERNATIVE

An analysis of how the Army could use TIDS and what TIDS could replace was performed to support a first order sizing of the mix of CORCOM 85 equipment and its likely distribution throughout a typical 1985-era corps. In addition, it was assumed that there would be a modest cutback ($\sim$ 10%) from the currently planned amount of conventional, voice-oriented subscriber and transmission equipment.

This assumption is supported by the fact that the ratio of subscriber equipment to personnel within a corps and division has been rising steadily. It now stands at roughly one telephone, teletype or radio terminal for every four people within the corps area and two such terminals for every five people within a typical division. In short, the Army is too "talkative." There is a developing consensus in the Army that there is less need for the thousands of telephones and radios in the current and projected inventories and greater need for organic data distribution systems.

The accompanying chart shows the number of each equipment type in the corps area and within the divisions and separate brigade. As before, the chart is color-keyed to the previous charts. The numbers for the terrestrial multichannel and single channel radios reflect the transfer of communications to TIDS and the satellite multichannel and single channel ground terminals. There is a net decrease in the total of voice oriented equipment. The rationale behind the indicated number of TIDS terminals will be discussed next.

DIVISION USE OF TIDS



19.0 DIVISION USE OF TIDS

A first order synthesis of a division wide TIDS network was performed. The network was assumed to serve diverse user groups corresponding to the TRADOC-defined Army systems. An augmented, notional corps comprised of two armored divisions, a mechanized infantry division, an infantry division, a separate infantry brigade and appropriate combat support and combat service support elements was assumed. The DA defined notional corps consists of over 160 unique Standard Requirements Codes (SRCs) corresponding, in general, to organizational units. These units were grouped according to the TRADOC-defined systems and each grouping was analyzed in terms of its potential for participating in a TIDS network. The total of 1770 1985-era TIDS users throughout a corps on the previous chart were broken into "division slices" each containing 430 terminals. The remainder were assumed to serve the separate brigade. This division slice and some typical system and/or unit users are shown in the accompanying chart. In general, it was assumed that a TIDS terminal was deployed with each unit. For example, in the field artillery system, TIDS terminals would be deployed to the Firefinder radar, the 8" and 155 mm batteries, the fire support coordination center (FSCC), the TACFIRE computer, the fire direction center (FDC), the Copperhead team and the forward observers (FO) for a total of 9 terminals. A total of 101 terminals would be deployed to all maneuver unit elements down to the company level, including armored cavalry troops, as well to combat engineer battalions, the tank combat support companies and the forward medical units. Appendices II - VII list hypothetical TIDS basis of issue plans (BOIP) for each of the systems.

It should be pointed out that the indicated BOIP numbers represent an initial 1985-era use. It is not intended to represent the best, most likely or only use. TIDS certainly has the potential for much wider utilization. By 1990 or 2000 it could be as prolific as conventional telephone hand sets. The point is, that a start has to be made, and the 1985-era is probably the earliest date that could be met, given the present development of TIDS technology.

TIDS ISSUES

- Network connectivity
- Network management and protocol
- Network characteristics
- Network interoperability

20.0 TIDS ISSUES

TIDS is a concept. It is based on an emerging technology which appears to offer a new communications capability. However, before a TIDS network could become a reality for the Army, several important issues must be satisfactorily resolved.

The most fundamental of these is network connectivity. This is the ability to transfer information between geographically dispersed users without regard to the number of relays or the actual transmission path. The connectivity issue will be dealt with on succeeding charts.

Network management and protocol are the means - the procedures - the discipline - by which the network runs itself. They determine when certain terminals function as transparent relays at certain times for certain messages and others do not. They also control network entry and exit in such cases as the arrival of reinforcements, or the reassignment of air defense, artillery or electronic warfare assets.

At the moment three distinct versions of burst communication technologies are candidates for an Army TIDS network. They are the Class III Joint Tactical Information Distribution System (JTIDS) terminal which is still in the conceptual stage, DARPA's experimental Packet Radio program which is undergoing testing in the San Francisco Bay area, and the Army/Marine Corps Position Location and Reporting System (PLRS) which would have to be modified to meet the desired TIDS network characteristics. These three alternatives represent different design

philosophies, technology bases and engineering approaches. No attempt was made during this study to choose among these alternatives.

It is highly desirable that the Army's TIDS network be interoperable with the Air Force's larger JTIDS Class I and Class II terminals which represent earlier embodiments of burst communications technology and which are well suited to airborne relay operations. These terminals will be onboard Air Force aircraft engaged in close support, battlefield interdiction, and air superiority missions as well as on AWACS, special purpose intelligence and EW aircraft. Such interoperability would permit much closer Army and Air Force coordination than that envisioned in current doctrine. Improved coordination could offer revolutionary opportunities for improved intelligence, Air Force and Army operations and the use of the combined fire power of both services. If RF compatibility with JTIDS Class I/Class II is not provided this crucial opportunity may be lost.

Much more work needs to be done on the last three of these issues. The following charts will discuss the first and most fundamental issue.

CORCOM 85

NETWORK CONNECTIVITY

- Usually limits mobility or number of participants
- Connectivity – Information transfer between dispersed users without regard to the number of relays
- Joint MITRE/ECAC connectivity study
  - ECAC computer simulation and output
  - MITRE analysis
  - Determine physical bounds that limit connectivity
- Simulation
  - 3rd Armored Division
  - Europe I. Sequence IIA. D-Day
  - Representative TIDS configurations
- Status
  - Completed analysis of division-wide and field artillery TIDS configurations

21.0 NETWORK CONNECTIVITY

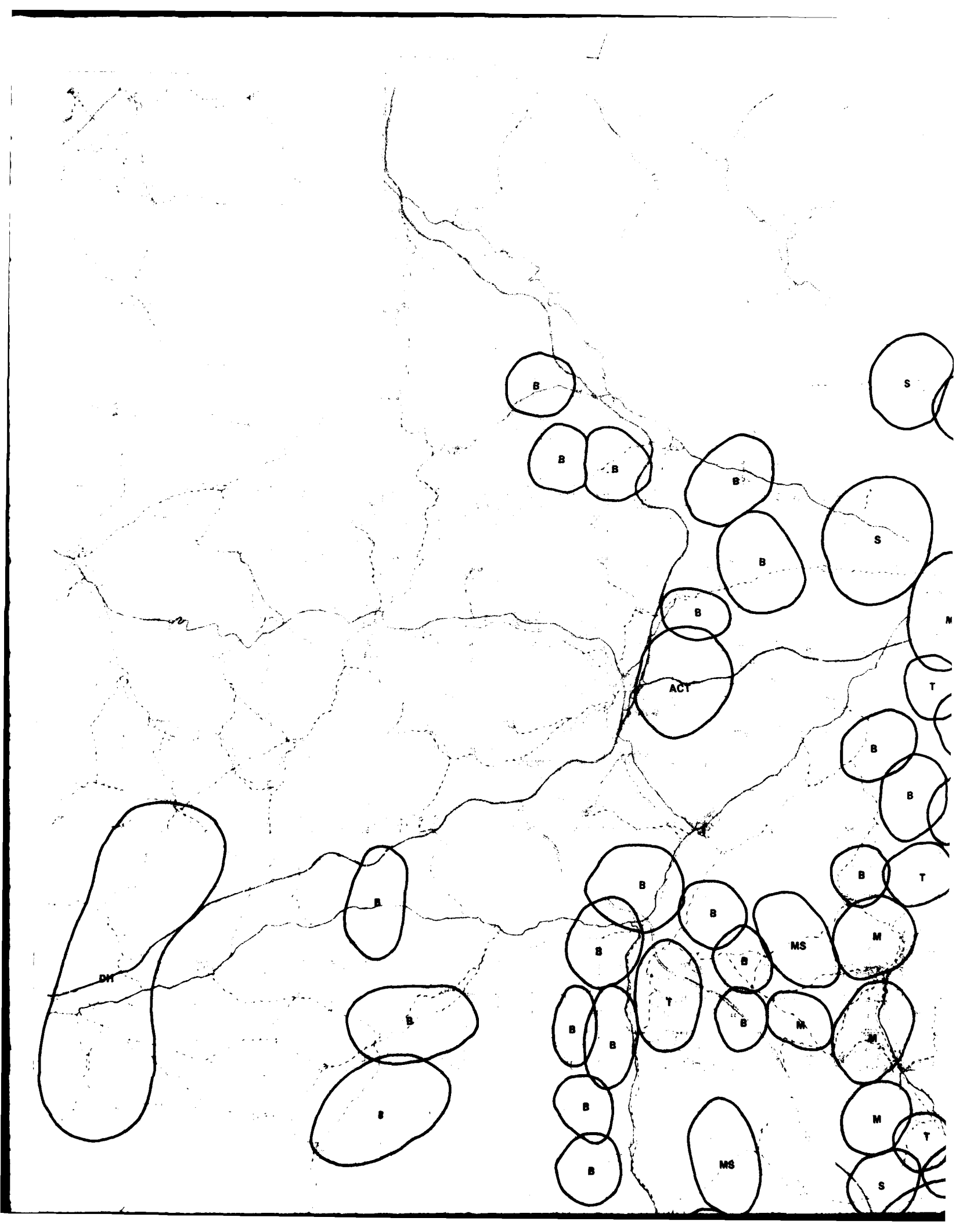
Network connectivity is the characteristic of a communications system that usually limits its mobility or number of participants. Terrestrial multichannel communications have good connectivity and a large number of participants but at the expense of mobility. Conversely, terrestrial single channel communications have good mobility but connectivity is limited to regular net participants unless provision is made for relaying messages via specially sited and configured relays.

A TIDS network has the potential for a high degree of connectivity among a large number of geographically dispersed, highly mobile users without the need to make special provisions for relays.

The MITRE Corporation and the Electromagnetic Compatibility Analysis Center (ECAC) are conducting an analytic investigation to determine the physical bounds (terrain, antenna height, deployment density, etc.) that limit connectivity.

An ECAC digital computer simulation of representative TIDS configurations in the 3rd Armored Division on D-Day of the Europe I Sequence IIA SCORES* scenario is being used to generate TIDS intervisibility statistics. As of this writing MITRE has completed analysis of the data for division-wide and field artillery system TIDS configurations. The next sequence of charts describes the results of this analysis.

*SCenario Oriented Recurring Evaluation System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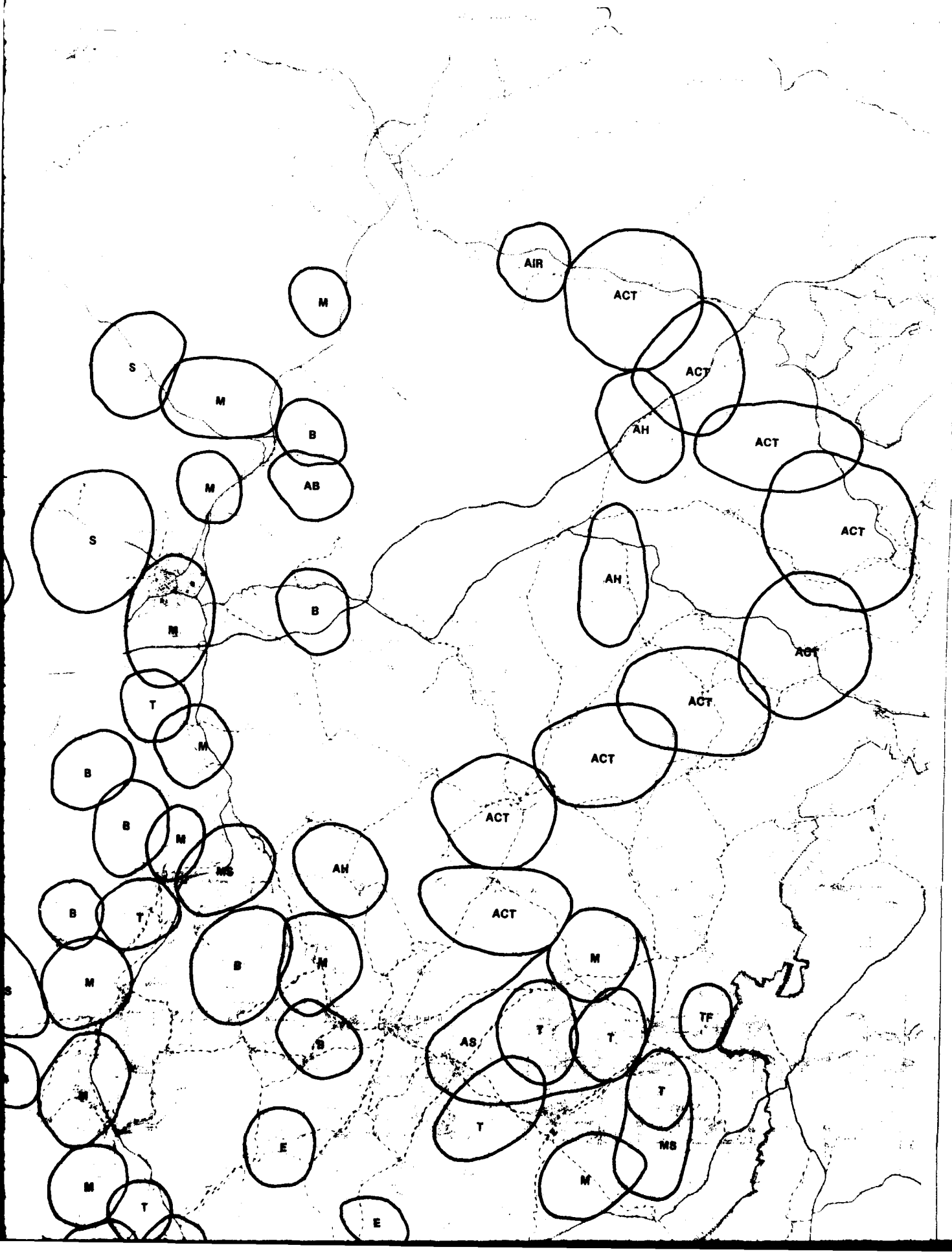
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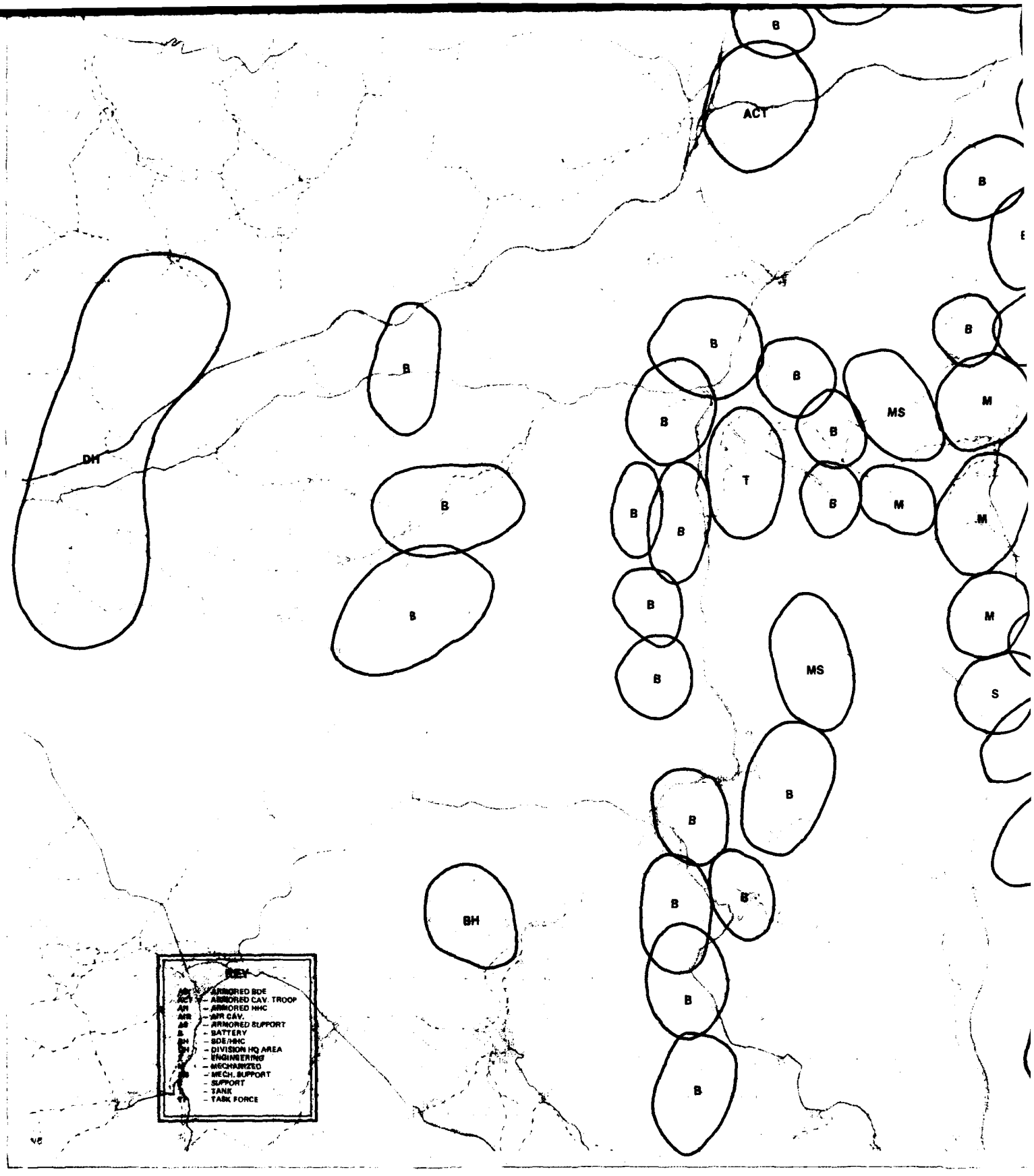
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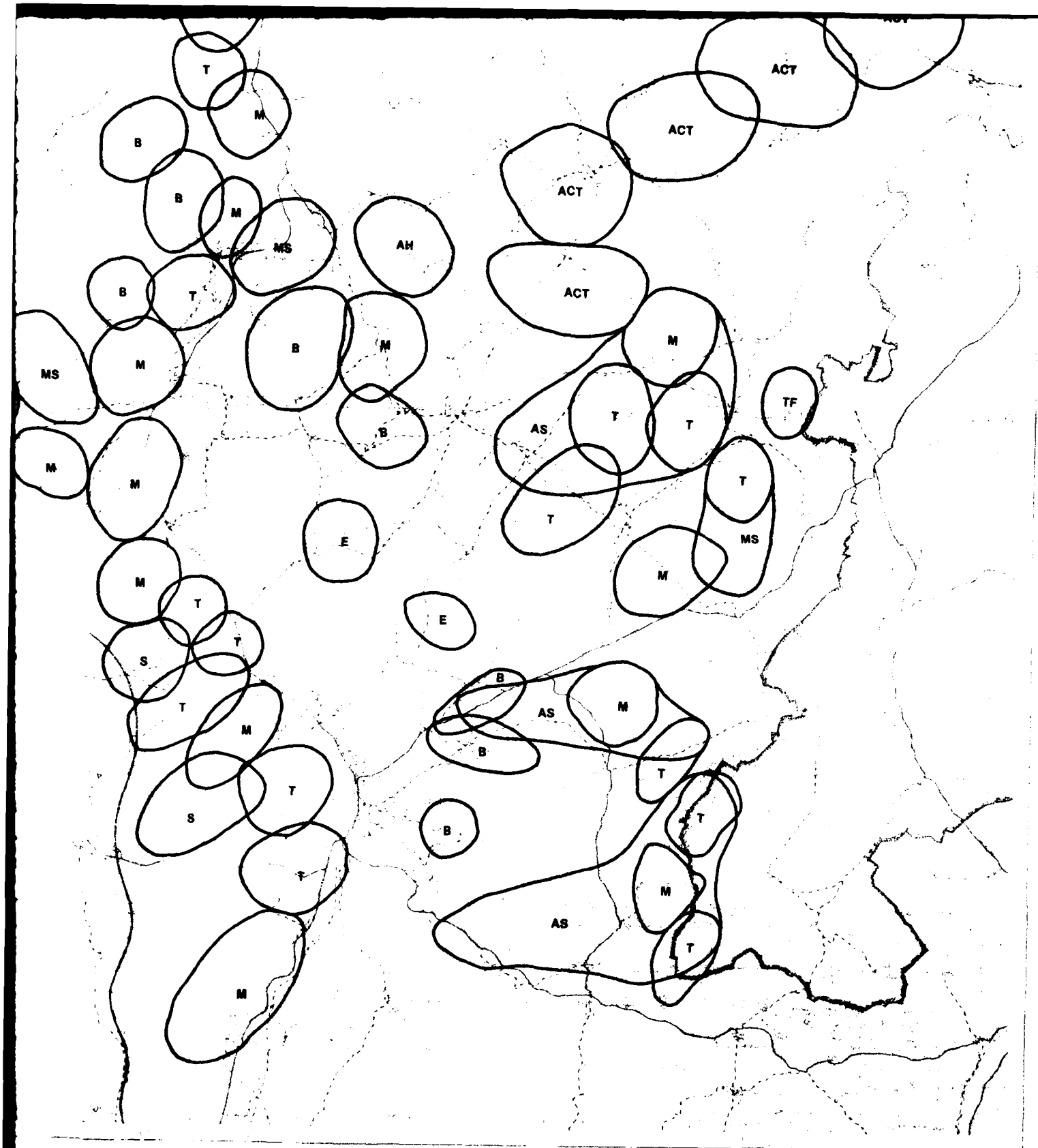
– AIR CAV.
– ARMORED SUPPORT
– BATTERY
– BDE/HHC
– DIVISION HQ AREA
– ENGINEERING
– MECHANIZED
– MECH. SUPPORT
– SUPPORT
– TANK
– TASK FORCE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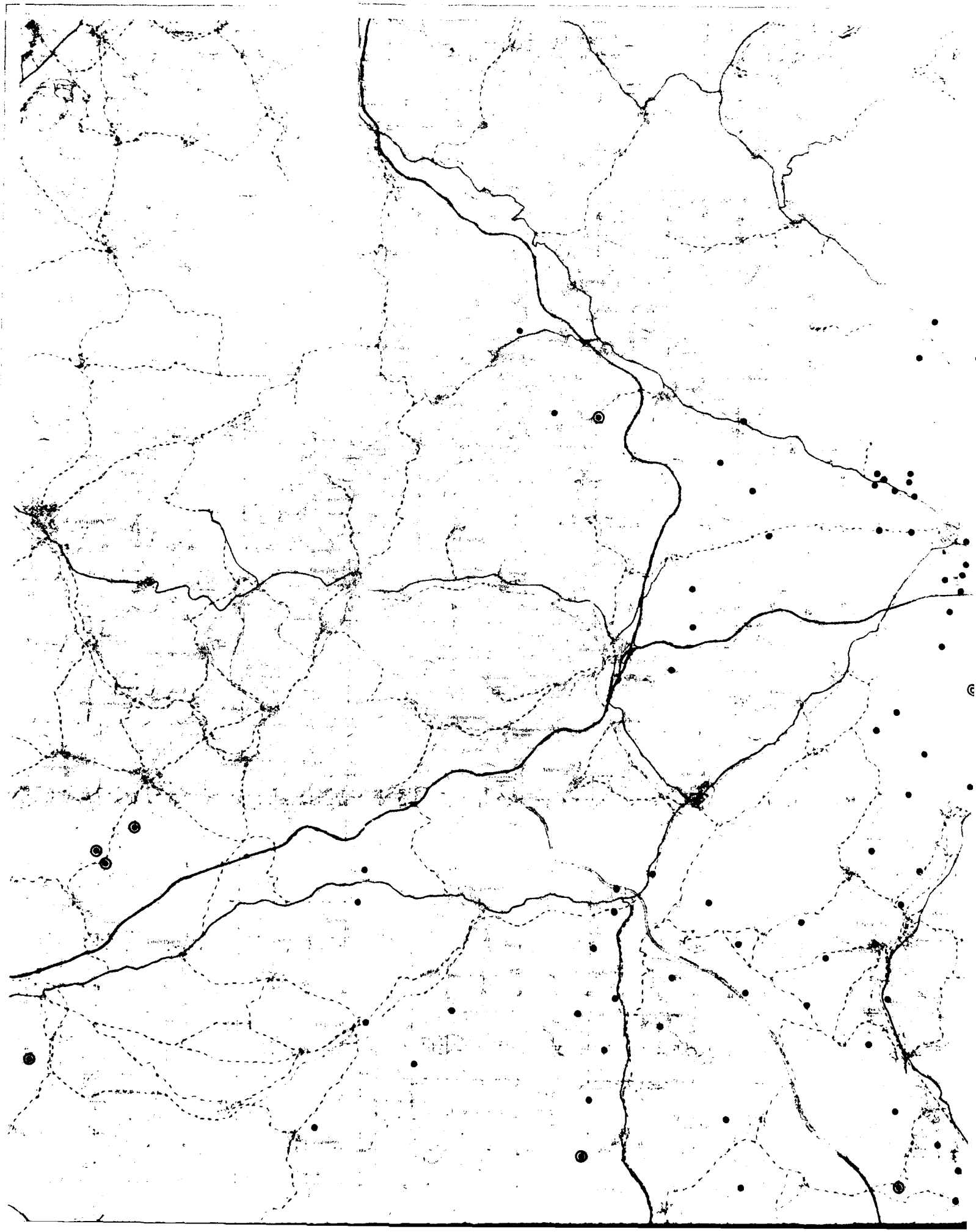
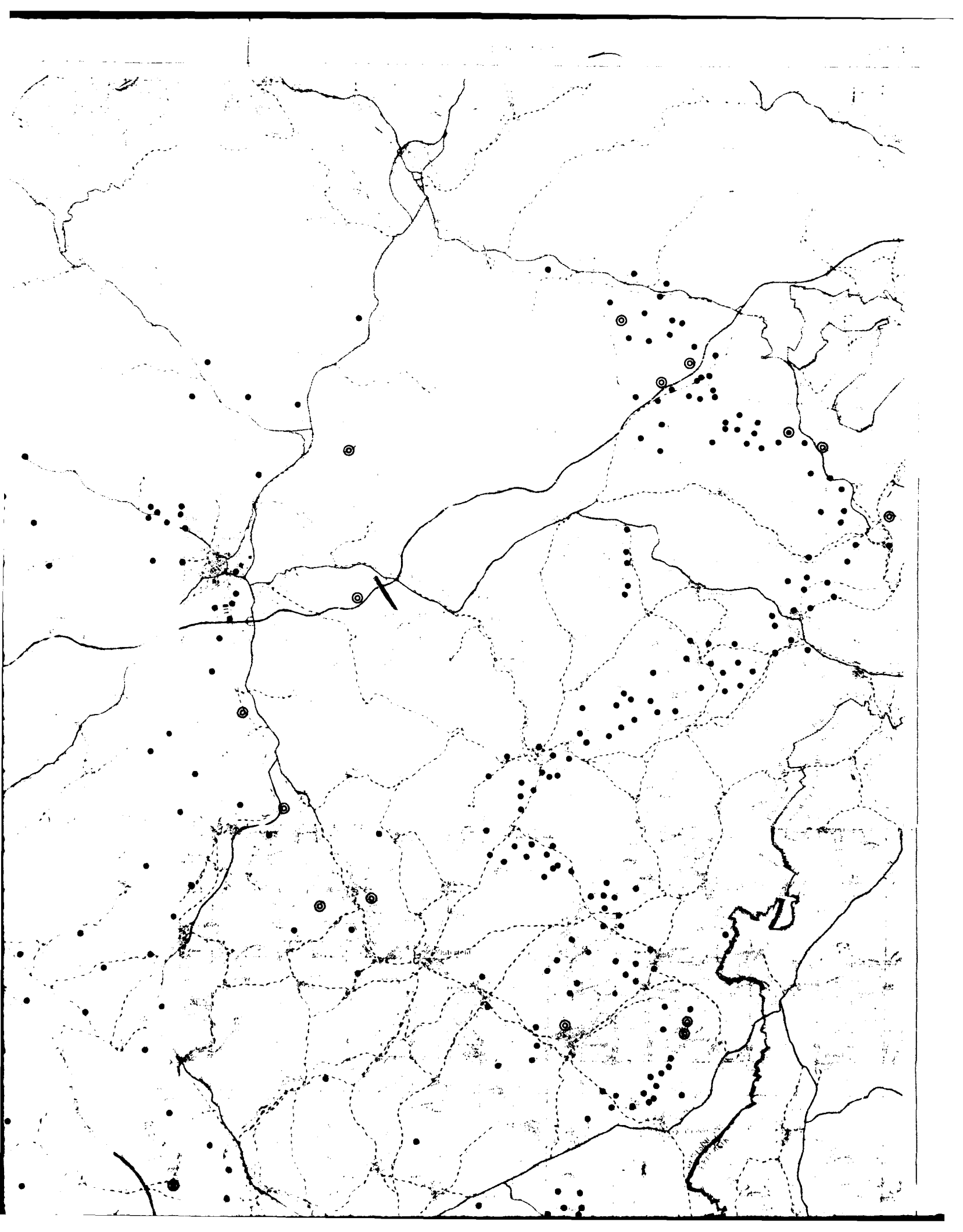
22.0 TIDS CONNECTIVITY STUDY: SCENARIO

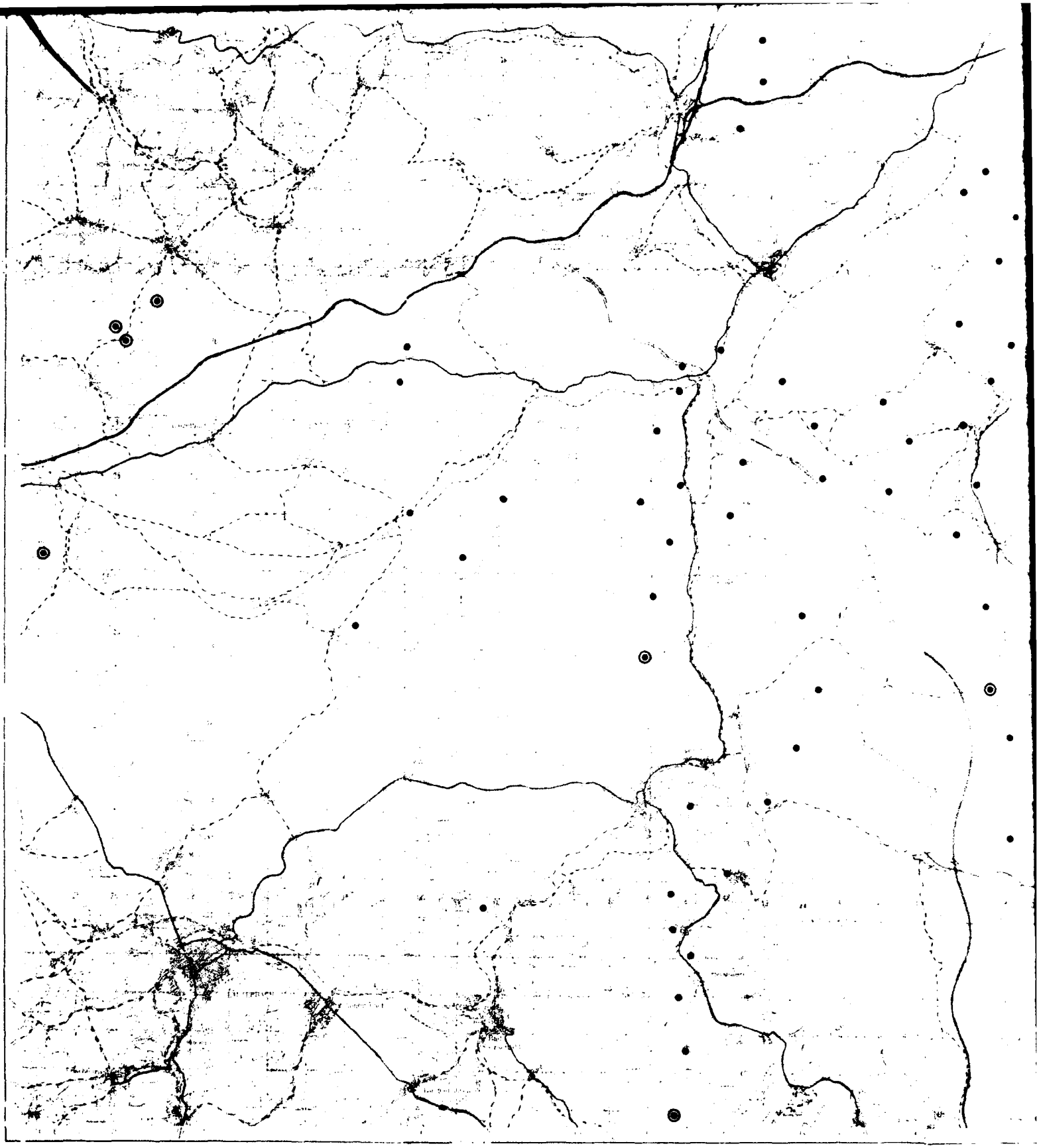
The 3rd Armored Division is shown deployed in the Fulda, Germany region as it would be at 1300 hours on D-Day according to a particular SCORES scenario.* The border between the Federal Republic of Germany (FRG) and the German Democratic Republic (GDR) is at the far right. VII Corps Artillery assets are also deployed in direct support of this division. A covering force action by armored cavalry elements, reinforced, is planned between the international boundary and the main battle functions in which the forward edge of the battle area (FEBA) will be located. The FEBA will generally run along the high ground north and south of Fulda. The terrain is fairly chopped up and undulating with the major corridors running north and south.

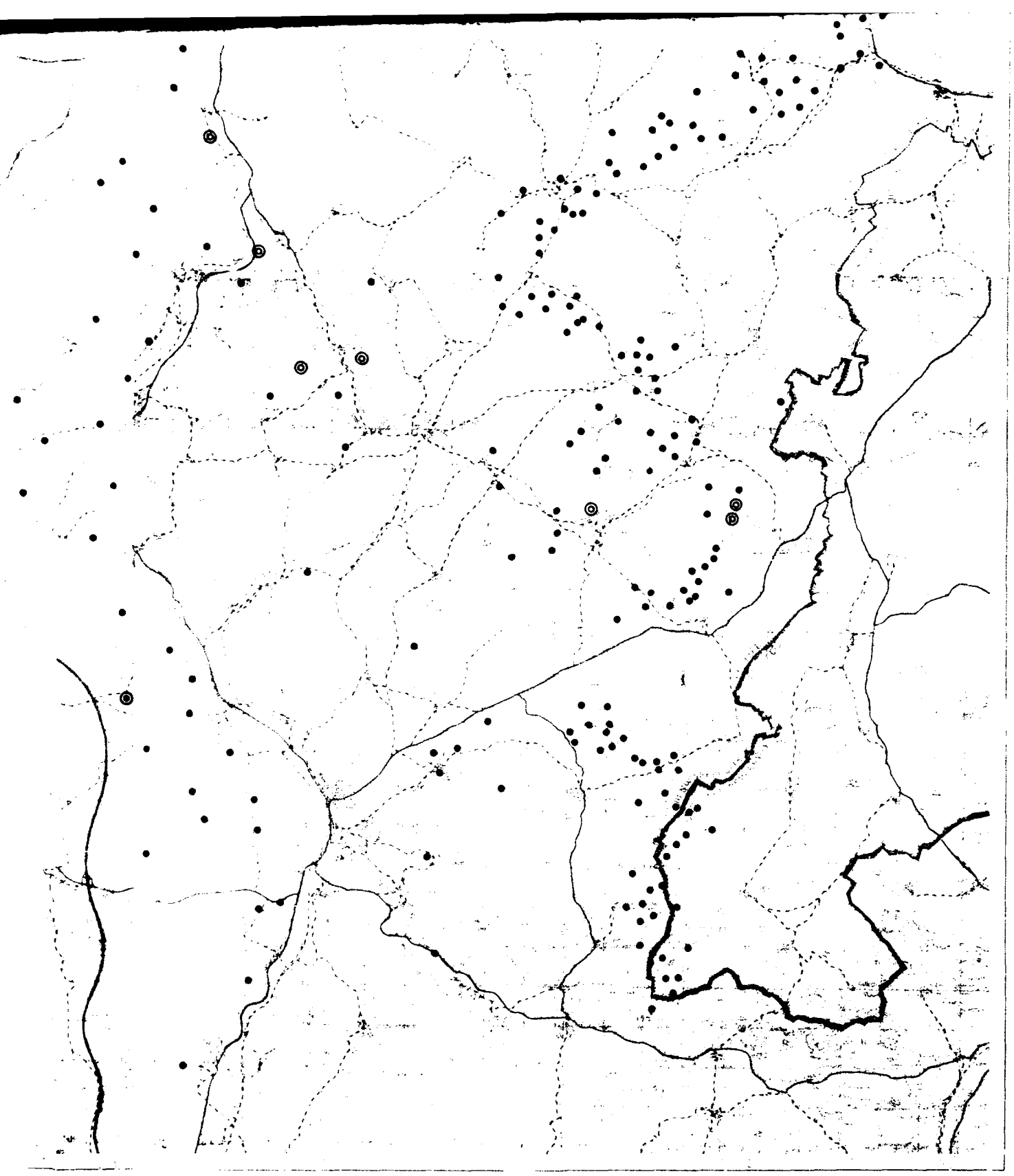
This is the setting assumed for the connectivity analysis of hypothetical TIDS network configurations.

*Europe I, Sequency IIA





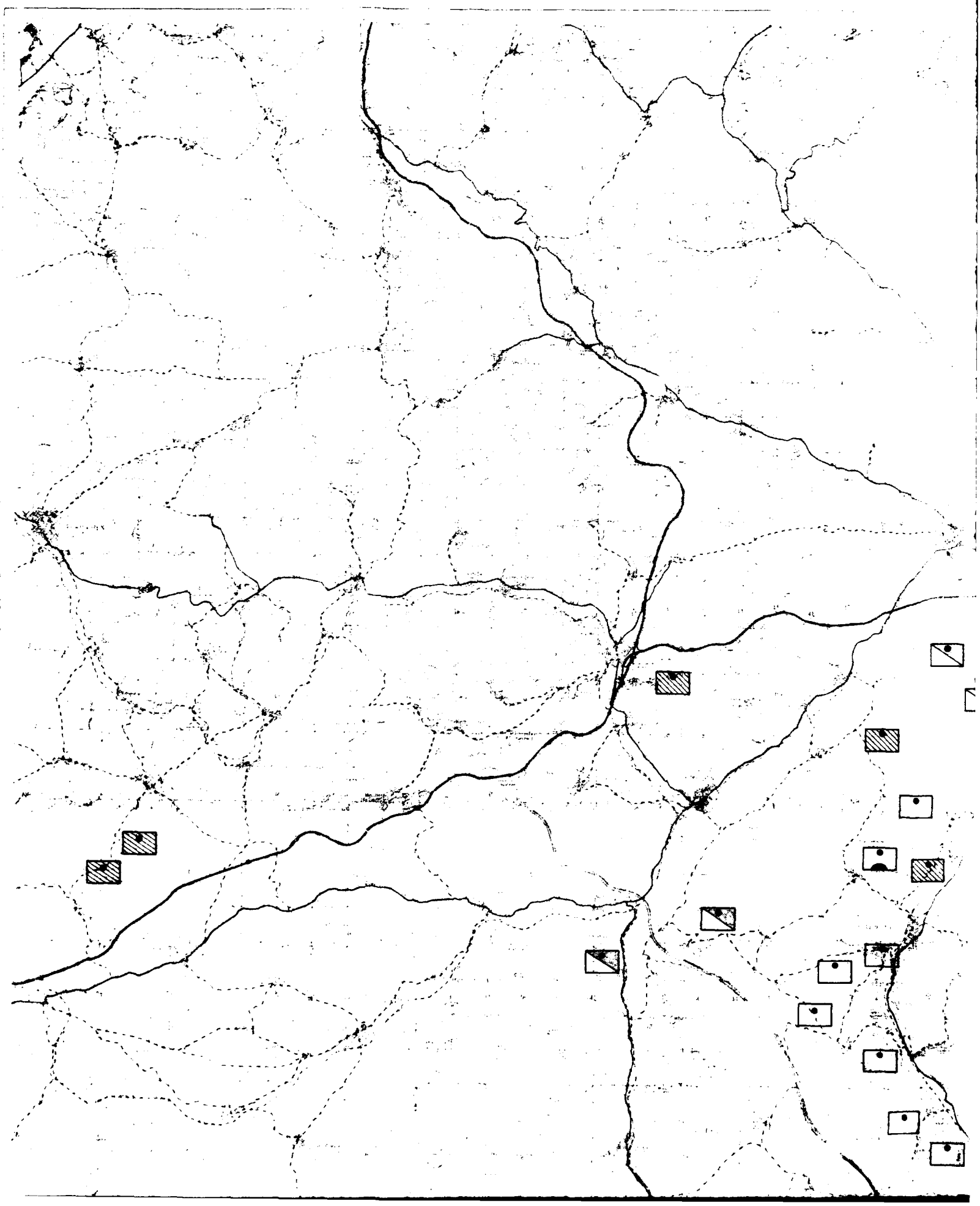


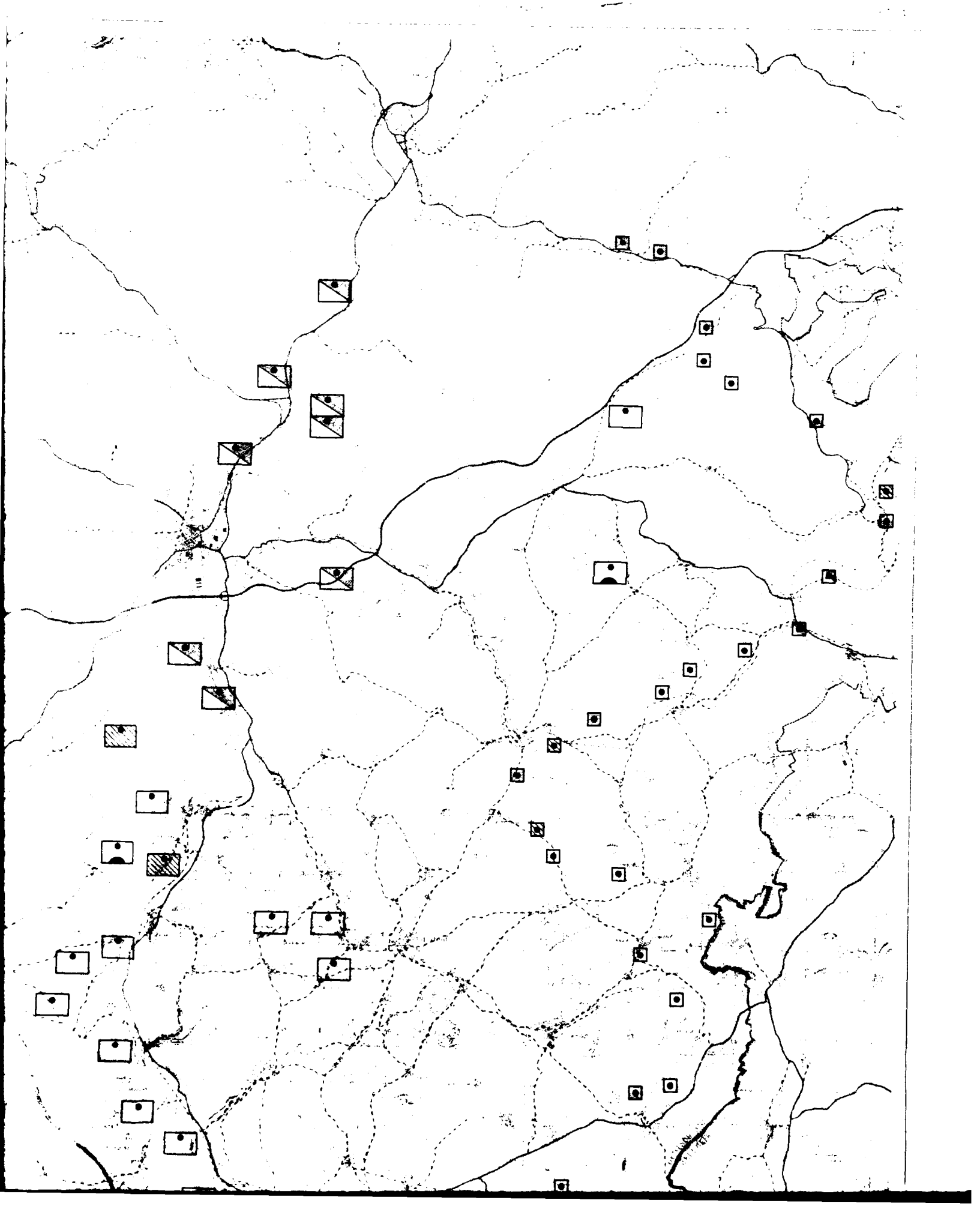


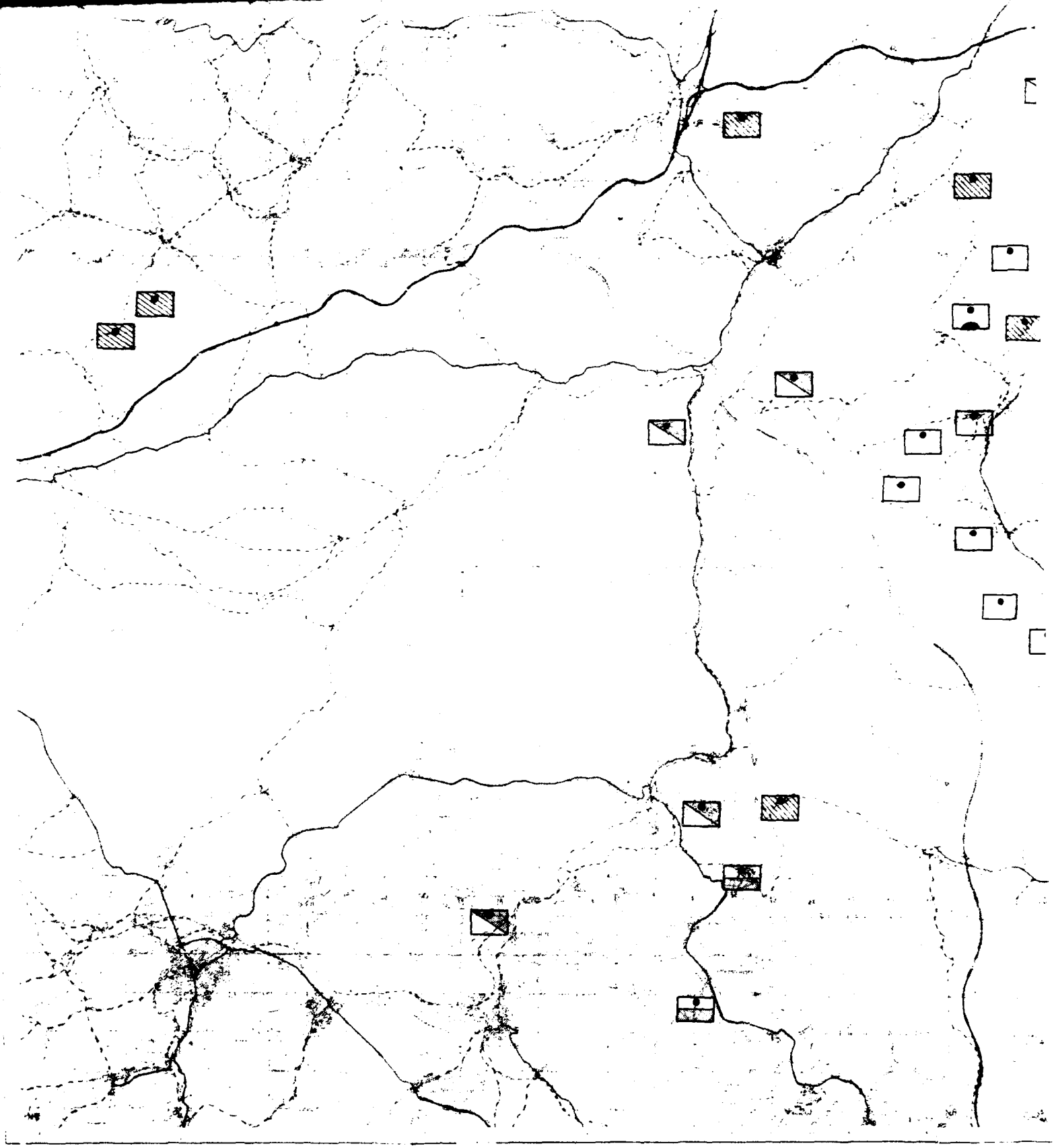
23.0 DIVISION TIDS NETWORK

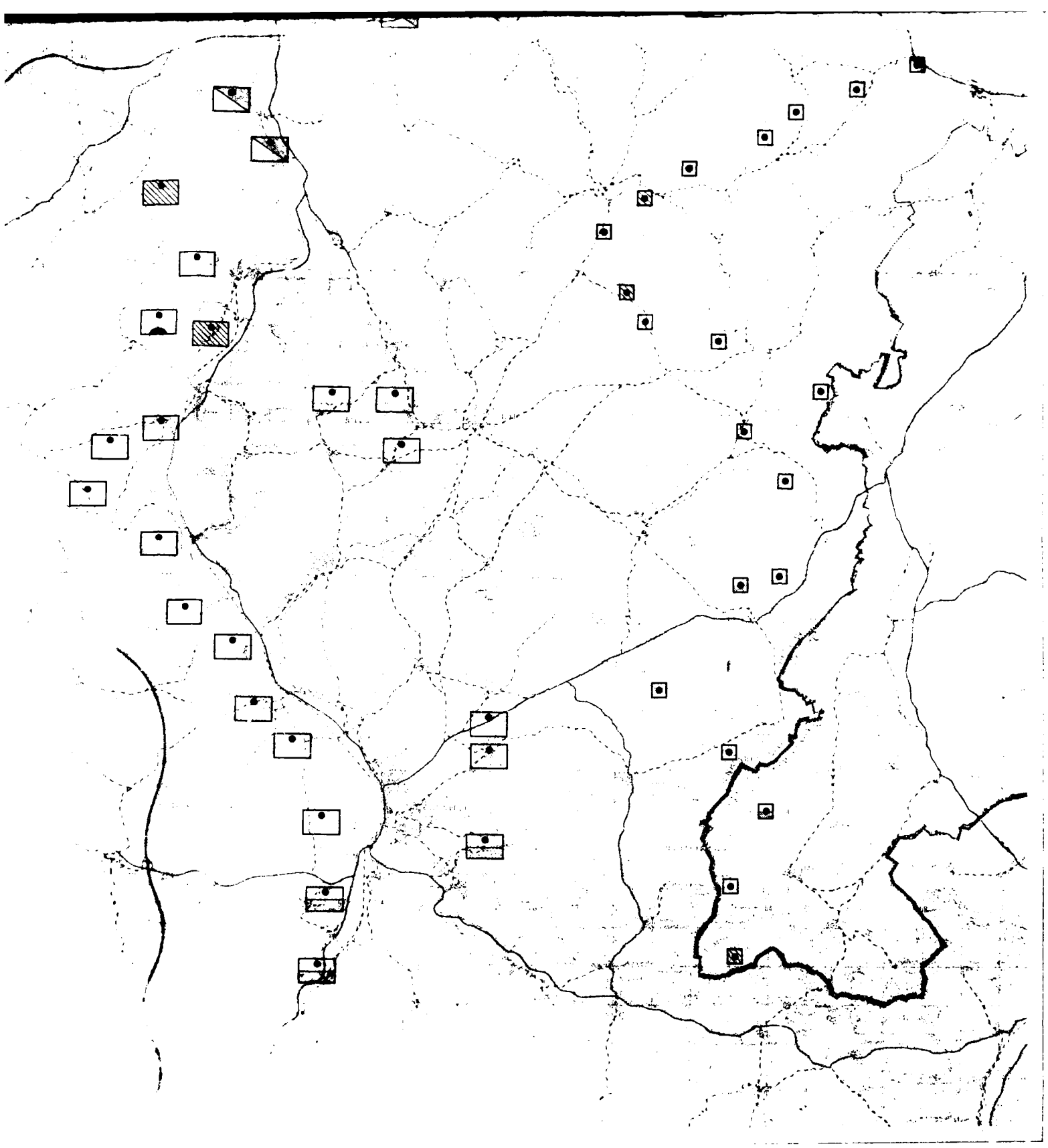
In order to examine the network connectivity of a division-wide TIDS configuration, TIDS terminals were deployed to combat units down to the platoon level as well as to major command posts for a total of 332 terminals. Eight foot antennas were assumed.

The simulation determined, for each terminal, all other terminals within radio frequency (RF) line of sight. These data were analyzed to determine the overall degree of network connectivity. Results of this analysis showed that 323 terminals were connected in an RF propagation sense; that is, assuming availability of RF power sufficient to overcome propagation losses due to vegetation and other anomalies, any one of the 323 terminals could be in real time communications with any other terminal by virtue of the self-relaying feature. The disconnected terminals included 1 subnet of 3 terminals and 6 totally isolated terminals. Providing specially sited or airborne relays could bring these units into the network. This analysis indicates good connectivity for TIDS configurations in excess of 300 terminals when distributed throughout a typical division deployed in very hilly terrain.









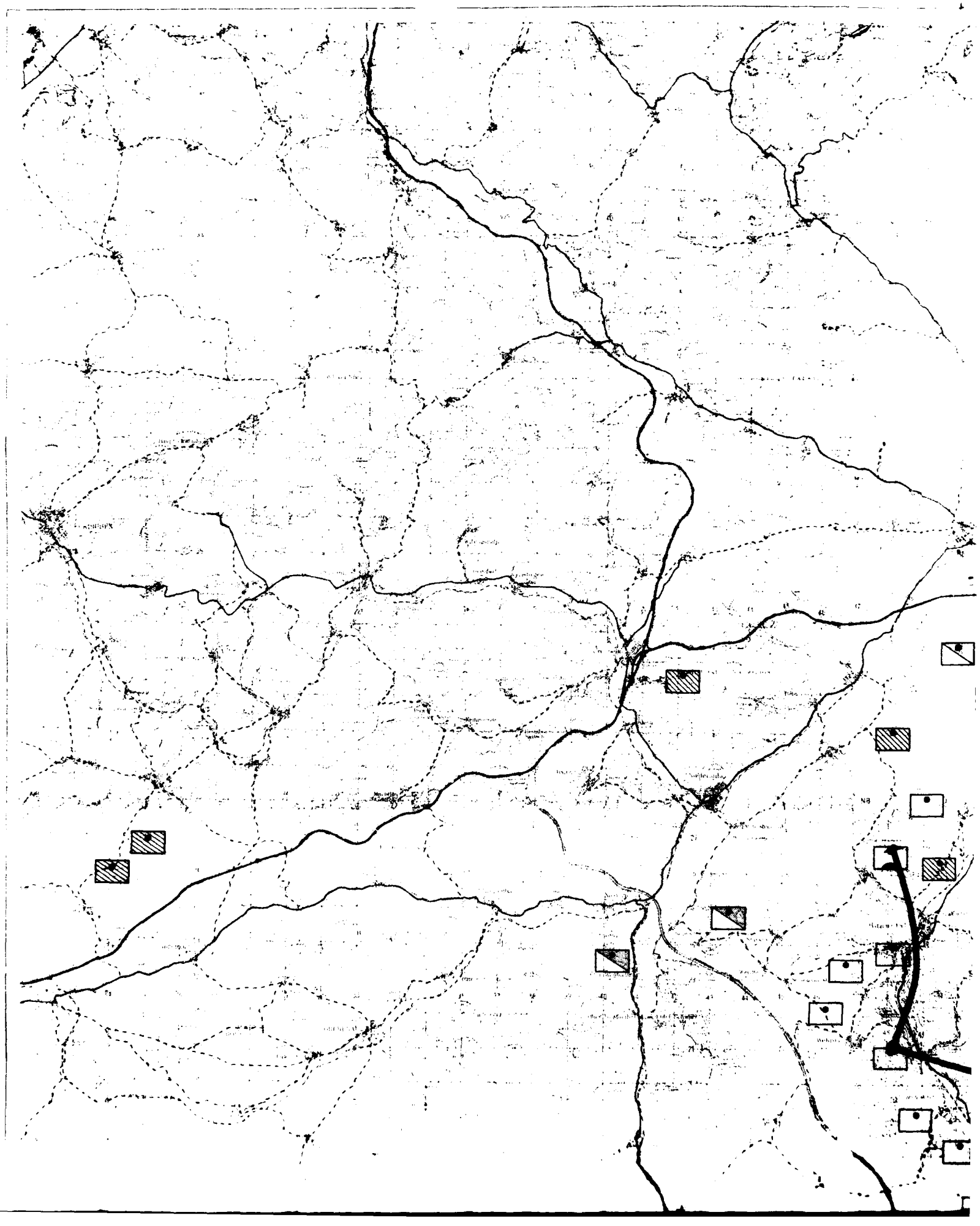
24.0 TIDS CONNECTIVITY: THE "CRITICAL MASS"

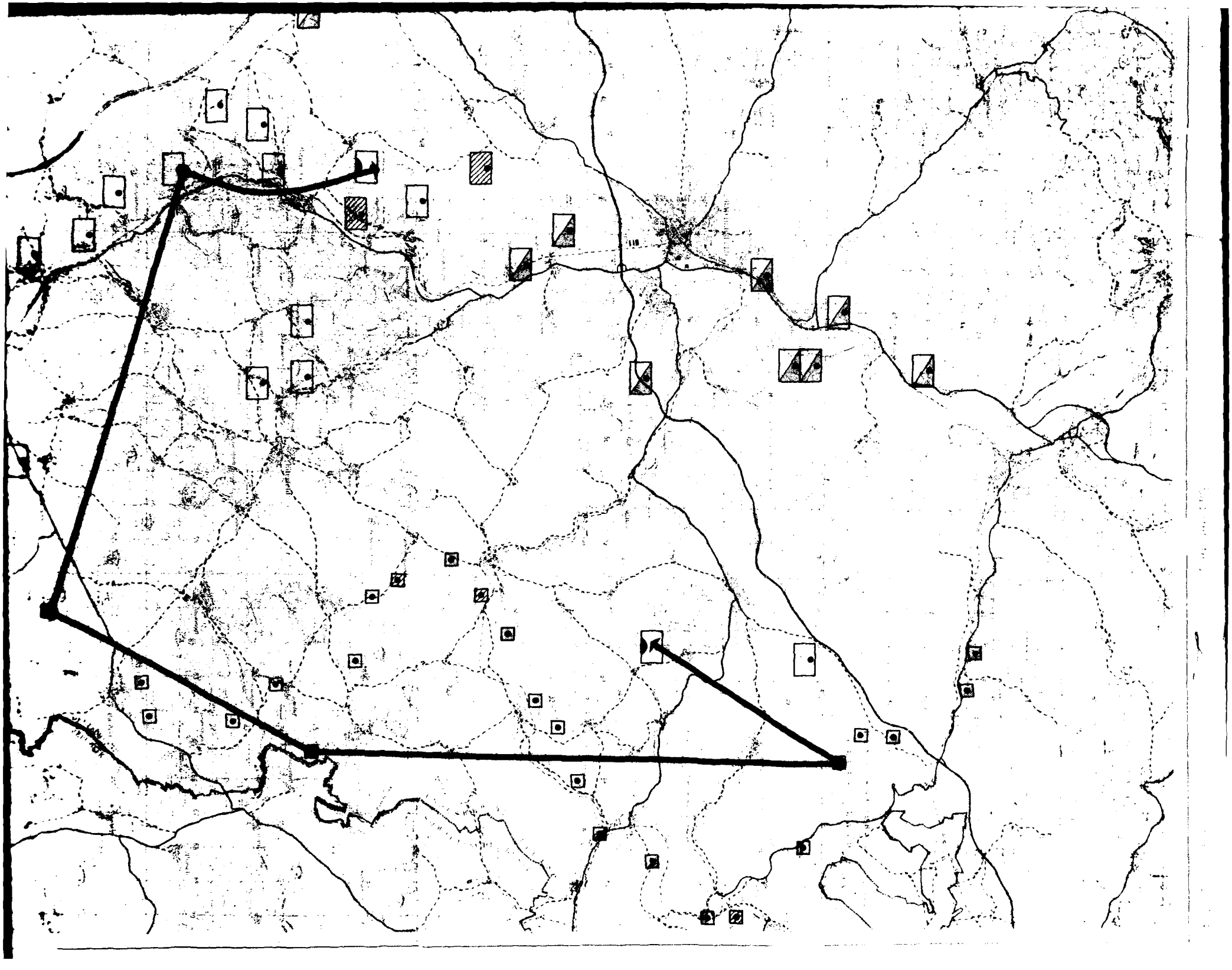
A subset of the 332 division-wide TIDS configuration was selected to search out a rough lower bound or minimum "critical mass" below which connectivity would be unacceptable. A low-density, 71-unit configuration, which might be representative of the division field artillery system, was analyzed. TIDS terminals were assumed deployed at 29 FO locations, 25 artillery batteries, all fire direction centers, the fire support coordination center, the division main and alternate headquarters, the artillery headquarters, the REMBASS* ground station and the TPQ 36/37 FIREFINDER radars. Results of the analysis revealed poor overall connectivity, indicated by the number of isolated subnets shown on the accompanying chart. The largest subnet consisted of 34 mutually connected terminals. For the rest, the analysis showed one isolated subnet of 12 terminals, two subnets of 3 terminals, five subnets of 2 terminals and nine totally isolated terminals.

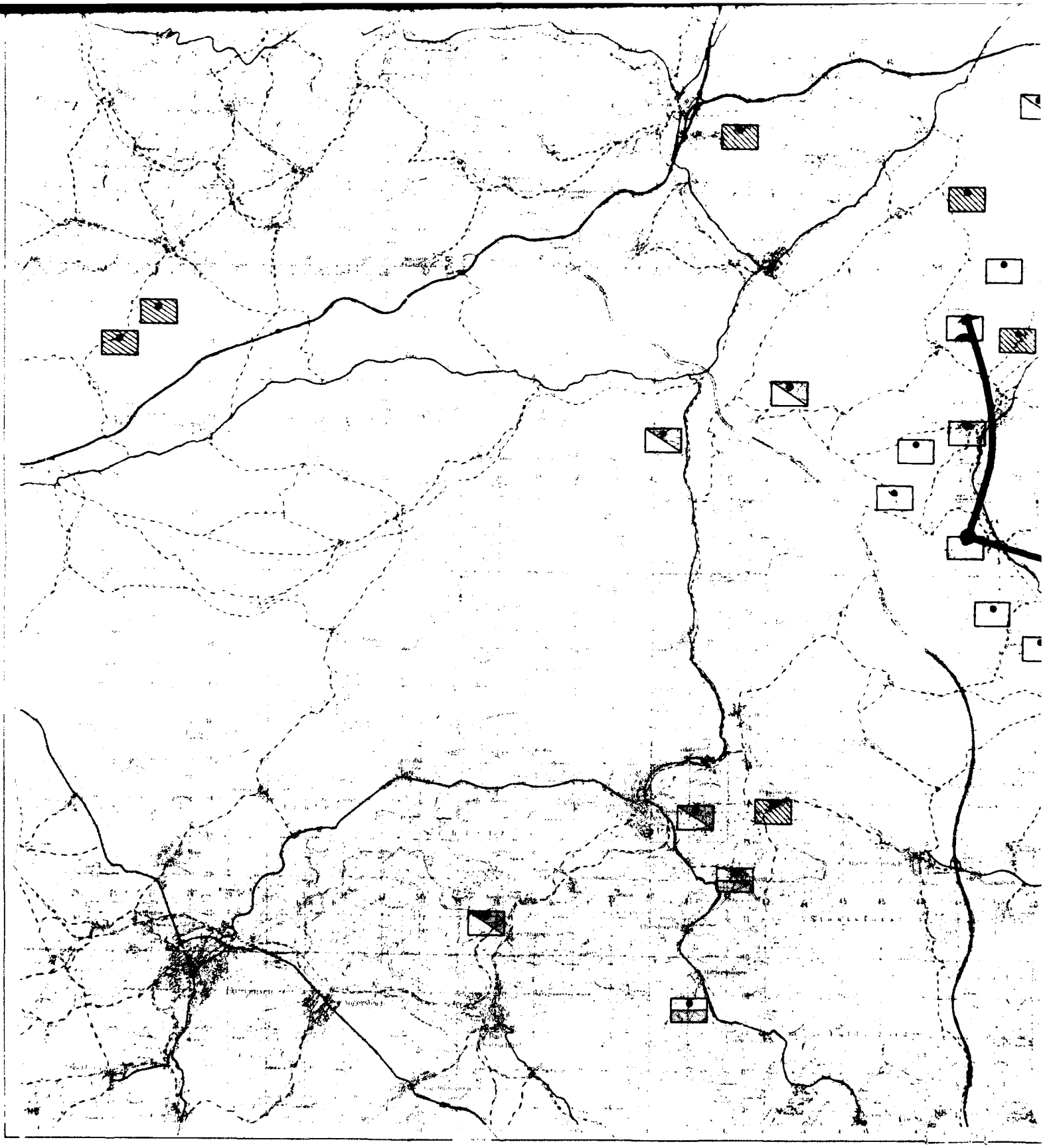
The provision of an airborne relay or of several, specially-sited gound relays would no doubt bring connectivity back up to a high level.

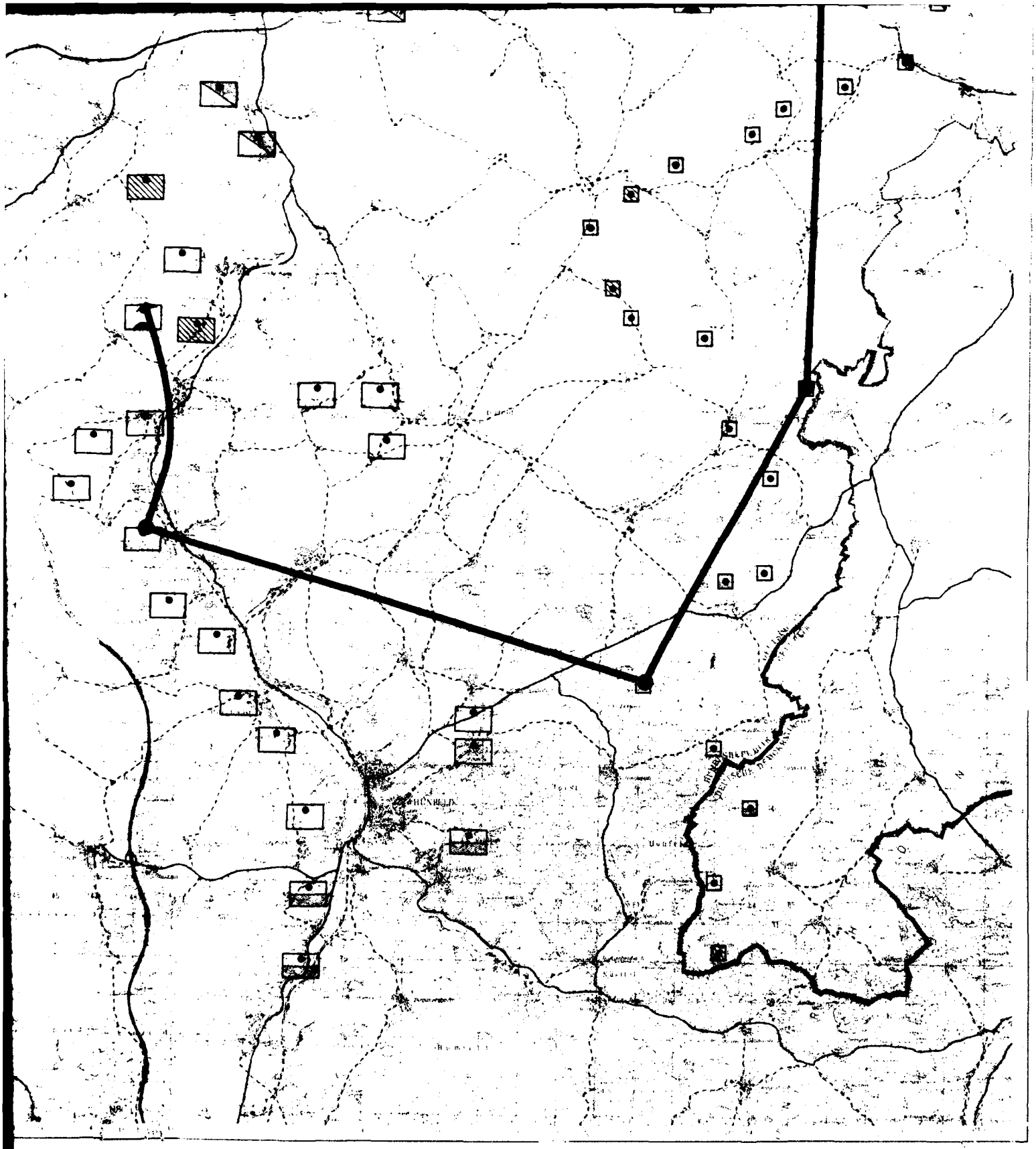
Additional analytical excursions, using the same basic case, but varying the geographic distribution of TIDS terminals and the number of terminals deployed between 71 and 332, should establish with greater confidence how many TIDS terminals are needed on the average to constitute a "critical mass," to assure a high degree of connectivity under assumed terrain conditions. In addition, the analysis will determine the sensitivity of the results to antenna heights and the presence of vegetation.

*Remotely Monitored Battlefield Surveillance System









25.0 TYPICAL SELF-RELAYING PATH

As an example of the TIDS self-relaying feature which provides connectivity for geographically dispersed terminals, the path connecting two of the terminals in the 34 unit subnet of the previously discussed field artillery TIDS configuration is shown. The unexpected circuitry of this particular path is evidence of the unpredictability of RF propagation in hilly terrain.

Part Five
Conclusions

CORCOM 85

REQUIRED ACTION

- Reallocate/reprogram funds for
  - Less ATACS, TRI-TAC, SINCGARS
  - More TACSATCOM ground terminals
- Define space-segment needs
  - More DSCS-III capacity
  - GPSCS
- Initiate aggressive TIDS development program
  - Determine specific utilization by various users
  - Define hardware/software requirements
  - Examine doctrinal/organizational implications
- Move quickly!

26.0 REQUIRED ACTION

CORCOM 85 outlines the future direction for battlefield communications. Further work is required to define equipment characteristics and to refine the equipment mix. Yet, it is possible now to prescribe three separate courses of action for each component of the triad.

First, the Army's use of conventional terrestrial multichannel and single channel communications must be reduced. The time to start the evolution from the current voice intensive posture is now. The way to do this is to re-allocate and/or reprogram funds committed to multichannel equipment (being developed by ATACS and TRI-TAC) and single channel equipment (e.g. SINCGARS) development programs.

Secondly, to achieve greater mobility, funds will be required for additional multichannel and single channel TACSATCOM ground terminals. In this connection, it is important that the Army clearly define its space segment needs and push forcefully to assure that they will be adequately provided. This probably means a greater share of the DSCS-III satellite transponder than was envisioned and every bit of the one third share of the joint GPSCS now in the planning stage.

Lastly, the key to future battlefield communications is a tactical information distribution system. To move in this direction, to start the evolution, an aggressive TIDS development program should be initiated. Efforts should focus on determining specific near term TIDS uses,

defining hardware and software requirements to guide technological development, and examining the doctrinal and organizational implications of TIDS for long term applications.

A particularly attractive element of this overall development would be Force Development, Test and Evaluation (FDTE) of existing "brass-board" TIDS equipment by elements of the U.S. Army Forces Command (FORSCOM). Such FDTE would provide "hands-on" user experience with TIDS hardware in limited but operationally significant applications and serve to validate analytical efforts.

27.0 SUMMARY

This report has outline a new tactical communications concept for the Army. The concept envisions a triad architecture composed of terrestrial, TACSATCOM and TIDS communications. A premise of this concept is that the continued heavy reliance on voice of the current and developing terrestrial multichannel and single channel communications hardware is ill-suited to future (1985 and beyond) battlefield operations. These will be characterized by the need for dynamic, timely information transfer from an increasing number of battlefield sensors and automated systems and among many widely dispersed highly mobile combat elements. TIDS is well suited to these future needs, and use of TIDS would initiate movement to a more balanced voice/data architecture.

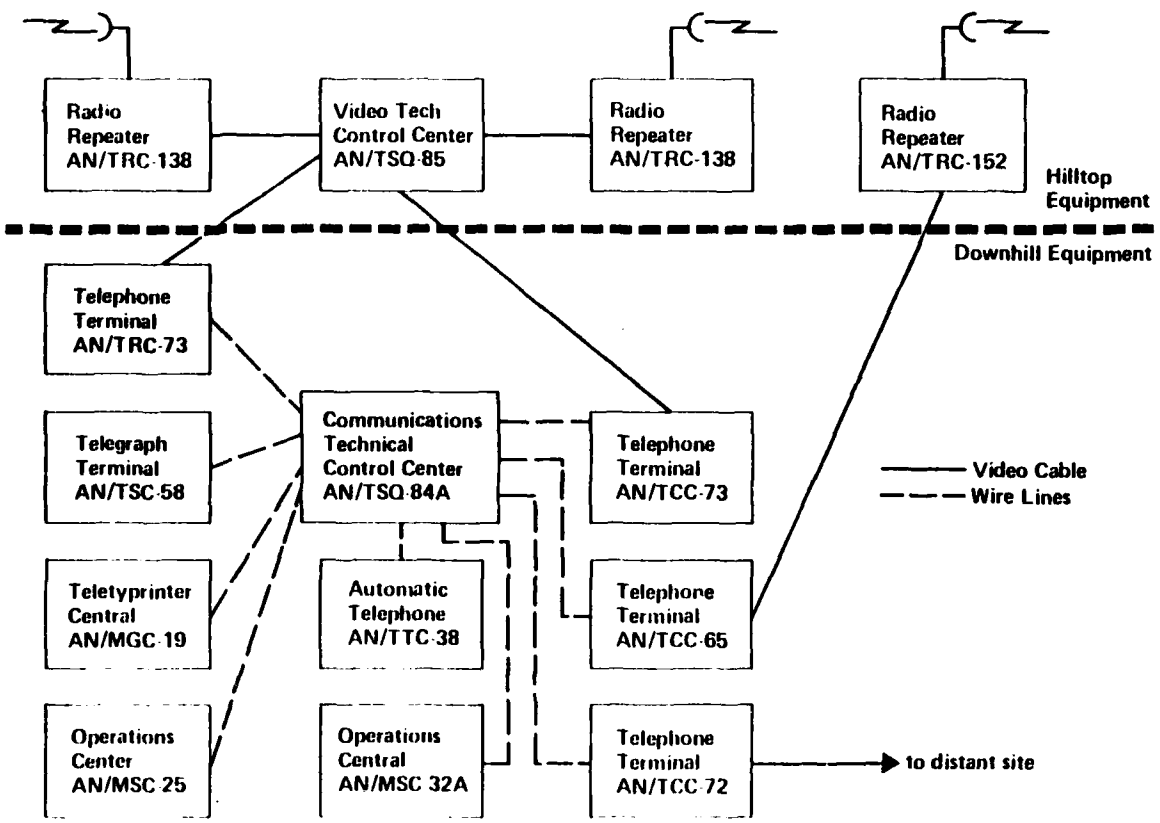
The report also suggests greater reliance on TACSATCOM to relieve some of the current and projected mobility constraints.

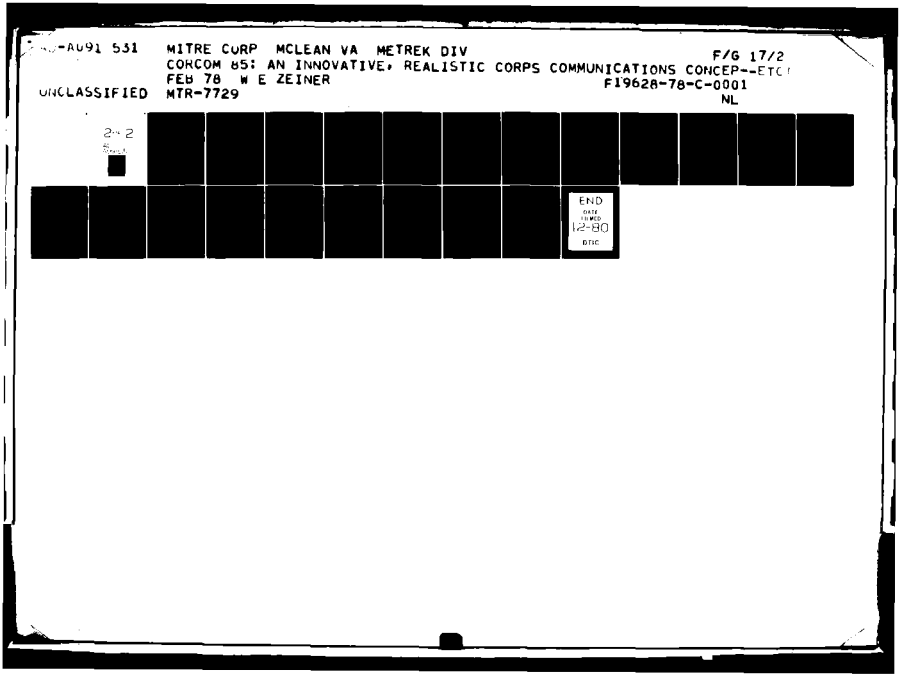
A concept for the use of TIDS by diverse Army elements and a projected equipment mix has been outline. Key TIDS issues, including network connectivity, were discussed.

The new concepts advanced in this report will have accomplished a major purpose if they serve to stimulate dialog within the Army tactical communications community about the future direction battlefield communications should take. Much remains to be done. But what is important, is to start now.

Appendices

CORPS AREA NODE — IMPROVED ATACS SYSTEM

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APPENDIX I

CORPS AREA NODE - IMPROVED ATACS SYSTEM

A corps area node is a complex of equipment assemblages comprising transmission, switching, multiplex, terminal and control gear. A typical corps area node consisting of hilltop transmission equipment for better LOS, and "down the hill" terminal and control equipment connected to the transmitter via wideband video cable, which may be as long as several kilometers, is shown in the accompanying chart. Users, perhaps at a distant site, are connected to the multiplex and switching equipment also via video cable. The AN/TRC-138 radio repeater is the "work horse" of the 48/96 channel high capacity system. The AN/TRC-151/152 is the extension equipment to a subordinate corps area unit such as a support group or engineer brigade.

This node is representative of the types of equipment currently planned for the 1981-83 time frame as part of the improved ATACS system.

SYSTEM/UNIT	TIDS FOR AIR DEFENSE SYSTEM BOI/DEPLOYMENT[1]		# PER DIV.	# PER CORPS	TOTAL IN CORPS[2]
FAAR	8 PER RADAR PLATOON OF HHB OF SP C/V BN		8		32
CHAPPARRAL (ROLAND)[3]	24 MISSILE SYSTEMS IN DIV. C/V BN		24	24	120
VULCAN (DIVAD)[3]	24 SP UNITS IN DIV. C/V BN		24	24	120
	C/V BN ADA FCS		1	1	5
	C/V BN AADCP		1	1	5
REDEYE/STINGER SECTION HEADQUARTERS	1 PER MANEUVER BN		9		36
REDEYE/STINGER TEAMS	1 PER MANEUVER BN, CAV. SQUADRON & FA BN		11		44
IMPROVED HAWK	1 BN PER DIV	RADAR	1	1	5
		4 BTRYS	4	4	20
		BN OP CTR	1	1	5
		REDEYE/STINGER TEAM	1	1	5

TIDS FOR AIR DEFENSE SYSTEM
BOI/DEPLOYMENT (CONTINUED)

SYSTEM/UNIT		# PER. DIV.	# PER CORPS	TOTAL IN CORPS
PATRIOT	1 BN PER DIV[4]			
	RADAR	1	1	5
	4 BTRYS	4	4	20
	BN OP CTR	1	1	5
	REDEYE/STINGER TEAM	1	1	5
DIV MAIN	DTOC	1		4
	TAC CP	1		4
	TSQ-73 BN	1		4
	ARMY AVIATION FLIGHT CONTROL CENTER ELEMENT	1		4
CORPS & ABOVE	CTOC		1	1
	TACC		1	1
	TSQ-73 GP		1	1
	REGIONAL AD CMDR		1	1
	AWACS		1	1
		96	69	453

NOTES:
1. SOURCES: FM 71-100, FM 44-1
2. 4 DIV/CORPS
3. ASSUMES DIVAD REPLACES VULCAN AND ROLAND REPLACES CHAPPARAL
4. SAME AS FOR IMPROVED HAWK

APPENDIX II

TIDS FOR AIR DEFENSE SYSTEM

A typical corps air defense system in the 1985 time frame will be composed of forward area alerting radars (FAAR), Chapparral (or Roland) short range missile batteries, Vulcan (or DIVAD*) air defense artillery guns, short range, heat-seeking man portable REDEYE or STINGER missiles and the long range, improved Hawk and Patriot systems. In addition there will be command and control elements such as the AN/TSQ-73 Missile Minder at both division main and corps headquarters. The basis of issue (BOI) assumed for these air defense units are listed in the accompanying chart.

It was assumed that each unit, battery or element would have a TIDS terminal for receipt and transmission of alert status, control of fires, target information, air defense intelligence information or command and administrative traffic. The extent to which TIDS can replace the mix of equipments which currently provide this capability is open to question. Current air defense communications include dedicated low capacity multichannel links for automatic digital data transmission and 2-way voice links between the group/brigade and battalion echelons as well as backup HF/SSB links, interbattery and interbattalion FM voice nets for command and administrative messages, automatic digital data links from FAARs to batteries, and wire where possible.

If needed or possible, additional multichannel circuits for secure record traffic, administrative/logistics traffic and liaison with Air Force elements are established.

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*The new 35mm division air defense (DIVAD) gun currently under consideration will replace Vulcan in the early 1980's.

During movement or when unable to use multichannel radio circuits, a combination of FM voice and HF/SSB provide the necessary links between the group/brigade and battalion headquarters.

TIDS FOR MANEUVER SYSTEM

	# PER DIV	# PER ACR	# PER SEP BDE	# PER CORPS	TOTAL
COMBAT ENGINEERS	6	1	1	19	45
MEDICAL UNITS	4			40	56
HHC, INF BN (MECH)	5		2		22
RIFLE CO, INF BN (MECH)	15		6		66
CSC, INF BN MECH-12TOW	5		2		22
ABN INF RANGER CO				1	1
ASLT HEL CO, SEP				2	2
HHC ARMD DIV	1				1
TANK CO, AR CAB SQ EQP W/MBT		3			3
HHC TANK BN 105 mm	6		2		26
TANK CO, TANK BN 105 mm	18		6		78
CBT SPT CO, TANK BN 105 mm	6		2		28
HHC ARMD DIV BDE	3				12
HHT, AR CV REGT		1			1
HHT, AR CV SQ ACR		3			3
AR CV TRP ACS ACRF W/AR/AAV		9			9
AIR CAV TRP ARMD CV REGT		1			1
DIV AVN CO, ARMD DIV	1				4
HHT ARMD CAV SQDN	1				4
ARMD CAV TRP, ARMD CAV SQDN	3				12
AIR CAV TRP, ARMD CAV SQDN	1				4
HHC, ATK HEL CO				1	1
ATK HEL CO, ATK HEL BN				3	3
	75	18	21	66	392

APPENDIX III

TIDS FOR MANEUVER SYSTEM

The maneuver elements of the division are the tank and mechanized infantry battalions, the cavalry squadrons, the attack helicopter companies, the combat engineers and organic medical units as well as certain combat support units. The accompanying chart lists these units and the number per division, separate brigade, armored cavalry regiment and corps.

A mix of LOS multichannel, VHF/FM net radio and HF/SSB (voice) and HF/RATT comprise the current communications capability. Primary means for controlling the maneuver units, however, is FM net radio. This is used for command/operations, intelligence, and administrative/logistics traffic. Multichannel communication links connect the division main and tactical headquarters directly to major subordinate command posts for control and coordination of tactical operations and connect the support command headquarters (DISCOM) to the forward support areas (Brigade "Trains") for administrative and logistic communications. Signal centers which include teletypewriter, telephone, radio, cryptographic and messenger facilities to supplement the organic facilities of units in their area, are located at the division main and division artillery headquarters, in the division support area and in forward support areas.

It was assumed in this study that each of the listed maneuver units would employ TIDS for command, operations, administrative, intelligence and logistics traffic where possible. Clearly, a detailed traffic analysis would be required to determine what traffic could be

supported by a TIDS network. Since much of this traffic is amenable to digital data representation and transmission (e.g., SITREPS, resupply requests, location reports and certain intelligence information) it is intuitively evident that TIDS could satisfy many of the communications needs of the maneuver system.

TIDS FOR FIELD ARTILLERY SYSTEM

UNIT/SYSTEM	# PER DIV	# PER ACR	# PER SEP. BDE	# PER CORPS	TOTAL
155 mm SP BTRY		3			3
HHB, FA BN, 155 mm SP	3				12
FA BTRY, FA BN, 155 mm SP	9		3		39
SVC BTRY, FA BN, 155 mm SP	3		1	2	15
HHB, FA BN, 155 SP			1		1
HHB, FA BN	1				4
FIRING BTRY, FA BN 8 in SP	3				12
SVC BTRY, FA BN 8 in SP	1				4
HHB, FA GP				2	2
HHB, FA BN, 8 in SP				9	9
FIRING BTRY, FA BN, 8 in SP				27	27
SVC BTRY, FA BN, 8 in SP				9	9
HHB, FA BN, 8 in SP				3	3
FA BTRY, 155 mm SP				9	9
SVC BTRY, FA BN, 155 mm SP				3	3
FA BTRY, TA BN	1				4
- TPQ-36	1				4
- TPQ-37	1				4
HHB, FA BN, LANCE (PERSHING)				1	1
FA BTRY, FA BN, LANCE (PERSHIN (PERSHING)				3	3
SVC BTRY, FA BN, LANCE (PERSHING)				1	1
HHB, DIV ARTY, (AIM)	1				4
FSCC	3	1	1		14
FDC	9	1	3		40
FO	27	9	9		126
AO	8				32
DTOC	1				4
CTOC	1				4
	72	14	18	67	387

APPENDIX IV

TIDS FOR FIELD ARTILLERY SYSTEM

The field artillery system consists of target acquisition sensors (AN/TPQ-36/37), fire support team (FIST) observers (also known as FOs), airborne observers (AOs), fire direction centers, fire support coordination centers as well as the individual 8-in. or 155 mm firing batteries. Division artillery (DIVARTY), corps and division tactical operations centers (CTOC, DTOC) and Lance (or Pershing) rockets at corps complete the system. The units comprising the field artillery system are listed in the accompanying chart.

Requests for fire can be originated by the fire support officer at the battalion or brigade FDC, by DIVARTY, or by the fire support element at a division forward command post based on target reports from the FIST, AO, the Combat Electronic Warfare Intelligence (CEWI) battalion, target acquisition battalion or other intelligence and target acquisition information available to DIVARTY.

The fleeting nature of targets in the modern battlefield and the limited availability of field artillery weapons require the timely detection, identification, and accurate location of targets in sufficient detail to permit their rapid analysis, evaluation and attack. Effective communications is the key to this capability. Primary means of communications at the present time are VHF/FM net radio and to a lesser extent HF radio teletype circuits. Increasingly, target reports, requests and commands are being automated. TACFIRE is a computer-based C^2 system which provides for storage, processing and retrieval of target information input from the various

intelligence and target acquisition sources; correlates and combines target reports; and furnishes the most probable location and description of each target. It consists of computer-based facilities at DIVARTY and battalion FDCs and message entry devices at fire support elements, FISTS and AOs. TACFIRE currently relies on the VHF/FM net radio to provide this capability. However, this can lead to voice/data contention problems in actual operation if strict net discipline is not observed.

TIDS is "a natural" for this application. It could replace the need for many of the VHF/FM net radios, particularly those used by FISTS, AOs, fire support elements at FDCS and those at individual firing batteries.

APPENDIX V

TIDS FOR COMBAT SERVICE SUPPORT SYSTEM

The combat service support system (CS3) is designed to provide personnel, resources and services needed to keep all other systems operating. It includes the units and functions listed in the accompanying chart as well as the division support command (DISCOM) and corps support command (COSCOM).

The combat service support effort is primarily aimed at the brigades. Forward elements of the DISCOM, normally located in the brigade support area (aka brigade trains), provide supplies, maintenance, medical and transportation assistance. Each organizational support element in the brigade support area is part of a parent unit that is located in the division support area.

Support requests, acknowledgements, and other data pass between supported units within a division and the maintenance battalion with forward support units or the supply and transportation battalion; thence between the division support operation center and the COSCOM material management center.

Since much of this information is amenable to representation in digital format a TIDS network could clearly serve the CS3 functions. Currently, a combination of VHF/FM net radio, HF radio teletype and multichannel circuits serve as links for the combat service support system.

TIDS FOR INTELLIGENCE/EW

SYSTEM/UNIT	DESCRIPTION	# PER DIV./ SEP. BDE	# PER CORPS	TOTAL IN CORPS
LEFOX GREY	COMMUNICATIONS INTERCEPT		3	3
CEFIRE TIGER	AIRBORNE RADAR ECM		1	1
CAS ECM	CLOSE AIR SUPPORT ECM		3	3
TACELIS	COMMUNICATIONS INTERCEPT/DF		1	1
TACJAM (MLQ-34)	COMMUNICATIONS ECM	3	3	18
TLQ-15	COMMUNICATIONS ECM		3	3
CEFLY LANCER	AIRBORNE COMMUNICATIONS INTERCEPT/DF		4	4
AGTELIS	RADAR LOCATION/IDENTIFICATION		3	3
QUICK LOOK II	AIRBORNE RADAR LOCATION/IDENTIFICATION		3	3
TEAMPACK DF (MSQ-103)	RADAR LOCATION/IDENTIFICATION	3		15
TRAILBLAZER (TSQ-114)	COMMUNICATIONS INTERCEPT/DF	1		5
QUICK FIX	AIRBORNE COMMUNICATIONS INTERCEPT, DF, ECM	3		15
MULTEWS	AIRBORNE RADAR ECM	3		15
OV-1D	AIRBORNE TARGET ACQUISITION	1		5
SLAR	AIRBORNE MOVING TARGET ACQUISITION	1		5

TIDS FOR INTELLIGENCE/EW (CONCLUDED)

SYSTEM/UNIT	DESCRIPTION	# PER DIV/ SEP. BDE	# PER CORPS	TOTAL IN CORPS
SOTAS	AIRBORNE MOVING TARGET ACQUISITION	5		5
RPV	AIRBORNE TARGET ACQUISITION	5		25
GSR	TARGET DETECTION	~4		~20
REMBASS	TARGET DETECTION	~5		~25
MINI-ELS	EMITTER LOCATION	~5		25
CEWI BN	HEADQUARTERS, OPS CO, EW CO, GROUND SURV. CO.	4	4	24
OTHER C^2 + AF, NATIONAL ASSETS	EWIOC	1	1	5
	PCAC		1	1
	FCAC		1	1
	DCAC	1		4
	CTOC	1	1	1
	DTOC	1		4
	DIVARTY	1		4
	MAGIIC	1		4
		44	32	251

APPENDIX VI

TIDS FOR INTELLIGENCE/EW

The Intelligence and EW systems are comprised of a diverse family of reconnaissance, surveillance, target acquisition, electronic support measures (ESM), electronic countermeasures (ECM) and electronic counter-countermeasures devices. All of them are designed to exploit and make known to the commander information about the enemy's current, planned or possible activities or to allow him to disrupt enemy action or planning. The timely flow of information from and to these devices is vital to this process.

The accompanying chart lists those intelligence and EW systems which are likely to be available to the commander in the 1985 time frame. They represent current hardware developments and hence do not reflect the dynamics of current planning and thinking about future intelligence/EW concepts. Also listed are Army command and control elements as well as representative Air Force and national assets which participate in the intelligence and EW systems. It is clear that a tremendous amount and variety of information will be generated and processed by these devices and units. Current planning suggest a correspondingly great need for a variety of communications: VHF/FM and UHF/AM voice links, HF/RATT, and HF LOS multichannel links for record, voice and mission traffic. In addition, specialized data links (some of them wideband) from airborne or forward based sensors to ground stations or rear processing centers are being planned. Many of these links will have to operate over distances as great as 100 km or more; thus there will be need for repeaters. Over 400 separate communication links may be

needed for just the ESM and ECM equipment. One system, TACELIS, requires a link equivalent to one of the high capacity links in the corps area system. Others require secure single channel VHF/FM or UHF/AM radios.

The use of TIDS by the intelligence/EW system is closely coupled with evolving EW and intelligence doctrines and the actual systems which result from new EW and intelligence concepts. Other factors include advances in signal processing and data link technologies which will permit a greater amount of local, decentralized, on-board (in the case of airborne sensors) processing thus alleviating the need to relay all collected data from the sensor; and changes in the manner in which EW and intelligence information is handled and disseminated to users.

For the purposes of this analysis, a TIDS terminal has been assumed collocated at the ground station, central processing station or C^2 element for each of the indicated systems/units. Only processed or target intelligence information is entered into the TIDS network. In some cases this may mean additional processing equipment not currently planned. In others, it may involve significant changes in the concept of operation. It should be emphasized that in this case especially the indicated TIDS utilization is representative or perhaps hypothetical.

The point is that TIDS will permit consideration of new ways of conducting EW/intelligence operations.

TIDS FOR AIR-GROUND SYSTEM

UNIT	BOI/DEPLOYMENT[1]	TOTAL IN CORPS
FORWARD AIR CONTROLLER	3 PER DIVISION	12
TACP-BN	9 PER DIVISION	36
TACP-BDE	3 PER DIVISION	12
TAC-DIV	1 PER DIVISION	4
TACP-DIV MAIN	1 PER DIVISION	4
TACP-CORPS		1
		69

+

AF UNITS
- TEREC
- PLSS
- RF-4C
- A-10's
- FIGHTERS
- AWACS

NOTES:

1. SOURCES: FA 71-100, DRAFT TC 100-15, FM 100-26

APPENDIX VII

TIDS FOR AIR-GROUND SYSTEM

The air-ground system includes those Army elements at each echelon in the chain of command who initiate, coordinate or request Air Force support. This support comes from a variety of Air Force aircraft such as close air support A-10's, battlefield interdiction and air superiority fighters, intelligence and EW assets and AWACS. In certain instances forward observers may also participate if the forward air controller is disabled or unavailable.

The accompanying chart lists the Air Force unit at each corresponding Army echelon at which a TIDS terminal would be deployed.

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